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How can environmental features influence and allow grade school students (typically 5-12-year-olds) with Attention Deficit Hyperactivity Disorder (ADHD) to thrive? There are approximately 6.1 million grade school students who have been diagnosed with ADHD (Centers for Disease Control and Prevention, 2021). This number is growing and neglects to include students who have not been medically diagnosed. ADHD in children typically causes hyperactive behaviors, impulsivity, and the inability to stay focused. Often, accommodations offered to students are extra time to work on assignments, breaks between assignments, alternative seating methods, reduced classroom sizes, and extra time at recess.

Although these are helpful, none of these accommodations aim to change the environment where the students are working. This study investigates innovative and alternative design solutions for designing school spaces that help eliminate specific symptoms often associated with ADHD. This study pays attention to daylighting, materials, transition spaces, acoustics, and access to nature through a speculative design approach to imagine designs that demonstrate creative solutions to accommodate neurodivergent students dealing with ADHD. By considering each of these features within the spaces designed for this project, research shows that this should create a more positive correlation between students' cognitive performance, distraction levels, and their environments.

SCHOOL DESIGN FOR STUDENTS WITH ADHD

by

Paige Bischler

A Thesis

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APPROVAL PAGE

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER I: INTRODUCTION

"I feel like an outcast." A close friend told me that trying to achieve academic success in school while at the same time, not drawing attention to themselves was nearly impossible. For the purpose of anonymity, I will refer to this friend as "R". Growing up with ADHD (attention deficit hyperactivity disorder) 'R' dealt with all major symptoms associated with ADHD- difficulty sustaining attention, hyperactivity, restlessness, and impulsivity.

Although 'R' was accommodated in their school through teachers addressing them with different teaching methods and techniques, they always felt like they were being singled out. Going to school became extremely frustrating and burdensome. What child wants to feel like an outcast? How could something like this be addressed in a different way? Would creating an environment that allows for them to feel included and accommodated be the answer?

This conversation just prior to entering graduate school in the Spring of 2019 had me wondering if there was something that interior design could do to help students with ADHD. Although there is a plethora of information about altering teaching methods to accommodate neurodivergent students (differing in mental or neurological function from what is considered typical or normal) there is less information about how to set up their learning environments for success. Through trial and error, and multiple precedents and research, I hope to provide strategies to implicate in the classroom to create the optimal environments for students with ADHD.

I am grateful to my friend for inspiring me and initiating this design process. It has been a joy to see this design come to life.

Project Abstract

How might interior environments play a role in accommodating students with ADHD? According to the Diagnostic Statistic Manual, Attention- deficit/ hyperactivity disorder (ADHD) is defined as a chronic condition that affects millions of children and often continues into adulthood

(Mayoclinic, 2019). ADHD includes a combination of persistent problems, such as difficulty sustaining attention, hyperactivity, and impulsive behavior (Mayoclinic, 2019). Because most typical cases of ADHD are diagnosed early on, this study will be looking at elementary schoolers. The opportunity for an earlier intervention in their school careers would cater more to their overall success in learning environments.

Recent studies show that ADHD rates are steadily growing. In most elementary school environments, accommodation is made upon request. These often include extended time for assignments, periodical breaks, smaller classroom sizes, alternative seating options (active seating), longer recesses or time outside (Centers for Disease Control and Prevention, 2019).

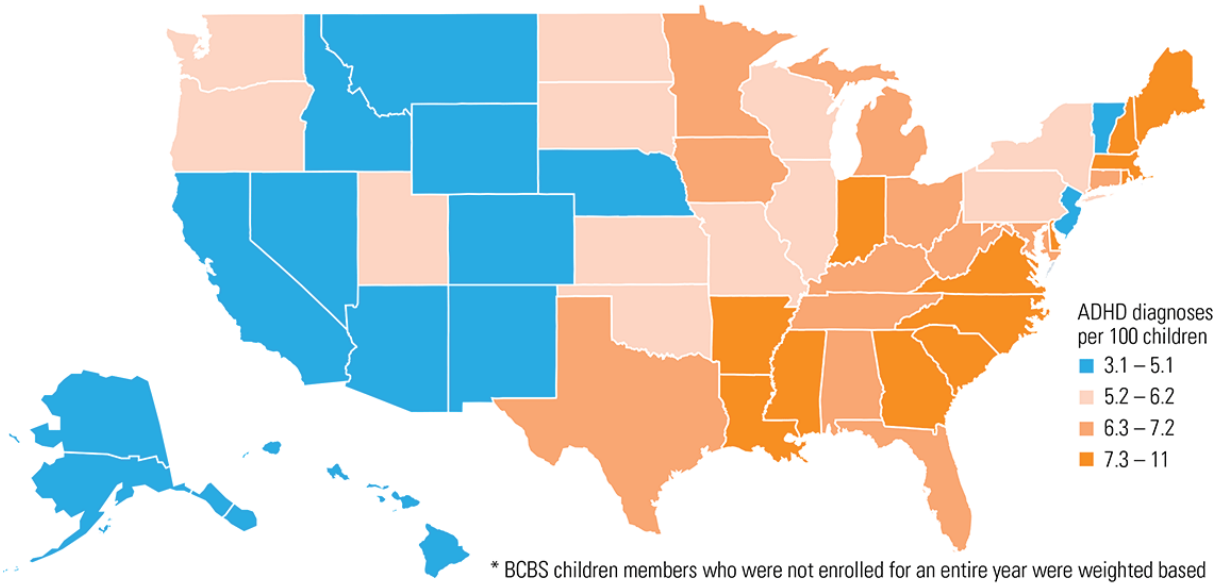
There are two environmental theories which may mitigate distraction and hyperactivity: Attention Restoration, and sensory integration (i.e., active seating).

The first theory, Attention Restoration Theory (ART), proposes that exposure to nature provides enjoyment but can also help improve focus and the ability to concentrate (Ackerman, 2019). Literature also suggests alleviating symptoms occurs through movement while using active seating (Remer, 2017). This includes sensory integration which is our ability to use our five senses and respond appropriately (Benn, 2017). Sensory Integration Theory suggests that the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment (Benn, 2017).

Additionally, acoustics and lighting (daylight and electric) are important to all populations, as they can become distracting when they are not at the proper levels (Fuermaier, 2018).

With this literature in mind, this leads to my research question: How can different environmental features influence and allow grade school students (typically 5-12 year-olds) with ADHD to thrive?

Figure 1. BCBS, The Impact of ADHD on the Health of America's Children



* BCBS children members who were not enrolled for an entire year were weighted based on the proportion of the year in which they were enrolled. For example, BCBS children members who were only enrolled for 6 months were counted as 0.5 BCBS children members.

CHAPTER II: RESEARCH

Speculative Design

Speculative Design is a term that refers to challenging difficult problems that we face today. This form of design is intended to open to new perspectives and allow a space for discussion and debate about alternative ways of thinking (Dunne & Raby, 2014). This term was created in the early 2000s by designers Anthony Dunne and Fiona Raby. According to Ivica Mitrovic, speculative design removes the borders traditionally defined by the different disciplines.

Through fictional narratives, film, screenplay, storyboard, user testing, interviews, questionnaires, games, media, and pop culture phenomena, the speculative design allows the designers to think freely and explore new ways of thinking (Mitrovic, 2017). The flexibility provided by speculative design allows the opportunity to push the boundaries and imagine new ways of doing things without restriction. This method will allow for the optimal learning environment to experiment and imagine new spaces without boundaries.

For this study, the speculative design will investigate new perspectives of classroom design. Through trial and error, renderings, space planning, and interviews with a teacher, this method will visit school design for students with ADHD through a fresh lens.

Figure 2. Ivica Mitrović, Diagram of Traditional Design vs. Speculative Design

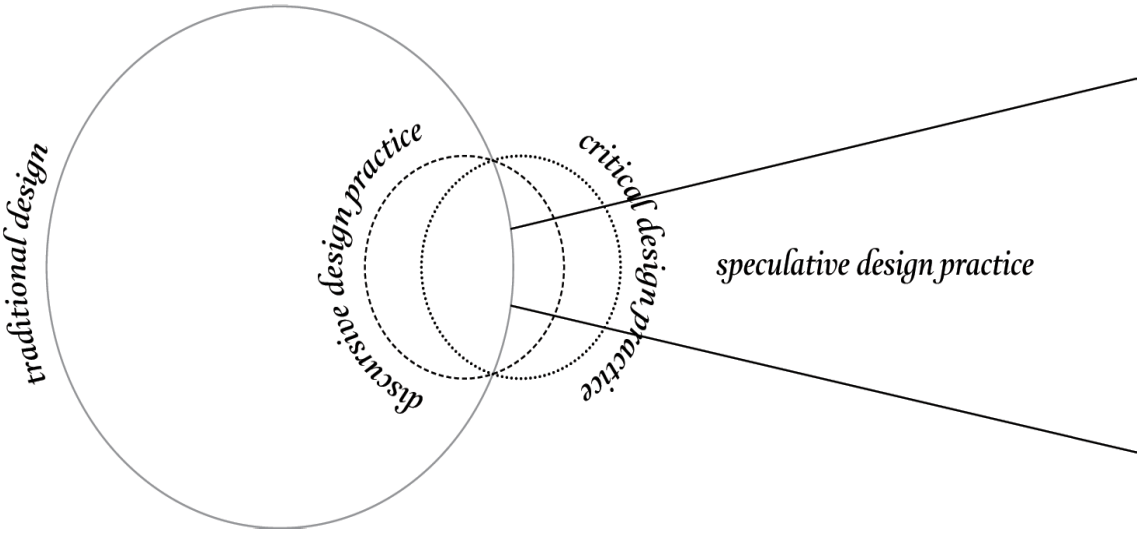


Figure 3. Ivica Mitrović, Speculative Design –Understanding Dystopian and Utopian future

Attention Deficit Hyperactive Disorder (ADHD)

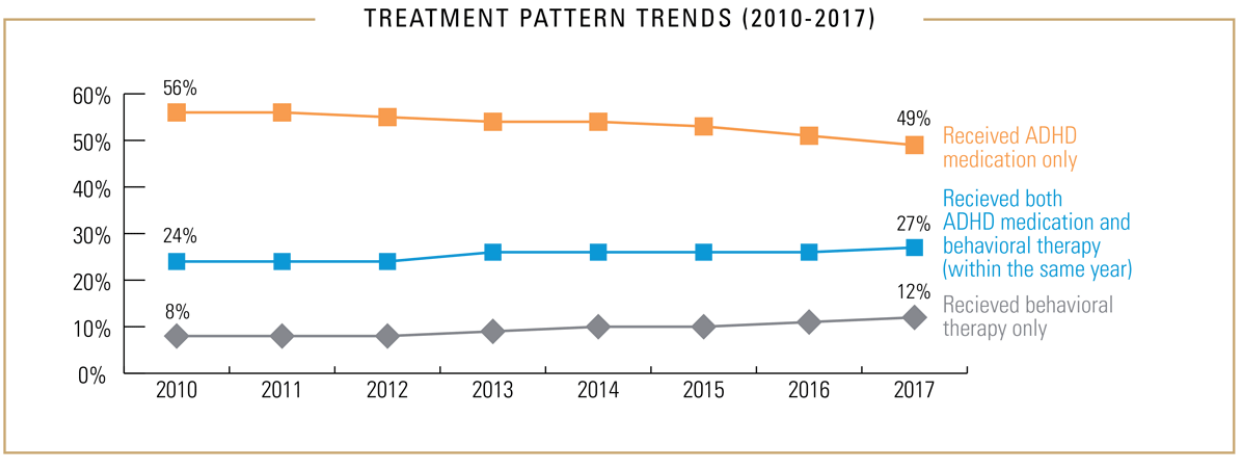
According to the Diagnostic Statistic Manual, Attention-deficit/ hyperactivity disorder (ADHD) is defined as a chronic condition that affects millions of children and often continues into adulthood (Mayoclinic, 2019). ADHD includes a combination of persistent problems, such as difficulty sustaining attention, hyperactivity, and impulsive behavior (Mayoclinic, 2019).

In general, ADHD is viewed as a disorder where people are overly hyper (Hutchinson, 2013). A definitive cause of ADHD is unknown, however, there is evidence that genetics are involved, as well as geographical location (Arns, Heijden, Van der, Arnold, Kenemans, 2013). Parents and siblings of people with ADHD are two to eight times as likely to have the disorder.

People are typically diagnosed with ADHD between the ages of 3 and 6 and it is usually due to genetic inheritance from parents, that affects males more than females (ADHD Editorial, 2020). Because most typical cases of ADHD are diagnosed early on, this study will be looking at elementary schoolers. The opportunity for earlier intervention in their school careers would cater

more to their overall success in learning environments. Recent studies show that ADHD rates are steadily growing, and this may be due to factors such as exposure to cigarettes and alcohol during pregnancy, premature births, and exposure to lead and other toxins (Froehlich, 2011).

Figure 4. BCBS, ADHD Treatment Pattern Trends



Approximately 9.4% (or 6.1 million) of grade school students have been diagnosed with ADHD (Centers for Disease Control and Prevention, 2021). This number is very high, and that is only including those who have been professionally diagnosed with ADHD. Students with ADHD are less likely to graduate than those who do not have ADHD (ADHD and College, 2019).

In elementary school environments, measures are taken to accommodate students diagnosed with ADHD upon request. These accommodations often include extended time for assignments, breaks between assignments, smaller classroom sizes, alternative seating options (active seating), longer recesses, or time outside (Centers for Disease Control and Prevention, 2019). Although these accommodations are helpful, learning environments cannot always be modified in such a way to optimize the user's experience. Due to COVID-19, learning environments have changed and reflect more than the traditional face-to-face classes.

According to Education Data in the Fall of 2021, 45% of elementary schools ran classes primarily online (Elearning Statistics, 2021). Furthermore, elementary school teachers have taken a survey and indicated that 36% of these students have had a "way worse" ability to focus during class (Harwin, 2020).

Approximately 9.4% (or 6.1 million) of grade school students have been diagnosed with ADHD (Centers for Disease Control and Prevention, 2021). This number is very high, and that is only including those who have been professionally diagnosed with ADHD. In addition to having ADHD, 4 in 10 children who have been professionally diagnosed with this disorder, have at least one other behavioral health disorder (Blue Cross Blue Shield, 2022). All of these symptoms and disorders have been shown to generate a lesser likelihood of graduating than those who are neurotypical (ADHD and College, 2019).

Figure 5. ***9.4 % of Students or 6.1 million children in grade school have ADHD***

Attention Restoration Theory (ART)

Attention Restoration Theory, also referred to as ART, was developed in the 1980s by renowned psychologist and professor, Stephen Kaplan. ART proposes that exposure to nature can improve our ability to concentrate (Ackerman, 2019). This entails exposure to natural elements as well as immersing ourselves in an outdoor surrounding.

Recent studies have shown that ART is beneficial to the ADHD community regarding cognitive performance. A study on the ability of natural environments to restore attentional capacity on 40 college students with ADHD applied ART (Thal, 2014).

Students took two cognitive performance tests (Stroop Color-Word Test, and Digit Span Backwards Test) and a questionnaire, before going on a 20- minute walk through the woods or city. After walking all students took the performance tests again and had improved scores. Those who walked through the woods performed the highest (Thal, 2014).

Thal's (2014) study results displayed the positive effect that nature (biophilic attributes) has on students with ADHD. Because access to nature seems to have a positive effect on the ADHD population regarding cognitive performance and hyperactivity levels (Ackerman, 2019), the proposed study will examine the ART.

Figure 6. ***Illustration of Laura Thal's Study***

Sensory Integration Theory

Sensory Integration disorder was developed by Jean Ayres, an occupational therapist and educational psychologist during the 1970s (Benn, 2017). Sensory Integration Disorder states that to function successfully in our environment, we must successfully integrate all our senses. In addition to the usually recognized five senses taught in school (sight, sound, touch, taste, and smell) Ayres directed much of her attention to two other (non-traditional) senses:

vestibular sensation (which senses acceleration and three-dimensional movement) and proprioception (which senses the position of a body part in space relative to the rest of the body) (Benn, 2017).

Our proprioceptive sense is the sense that helps a child with body awareness. The two sensory areas in our body responsible for this functioning, are our muscles and tendons.

The vestibular sense tells our body where it is in space. If this is not functioning properly, one's sense of balance may be thrown off. Our ears are responsible for enabling this sense.

Sensory Integration Theory suggests that the neurological process that organizes sensation from one's own body and the environment makes it possible to use the body effectively within the environment (Benn, 2017). ADHD symptoms are seen to improve with constant movement, because of this, it is worth further investigation. Looking at a population that by default can be easily distracted, it is important to review acoustics and lighting as they may become vital parts of the classroom design.

Figure 7. ***The Seven Senses***

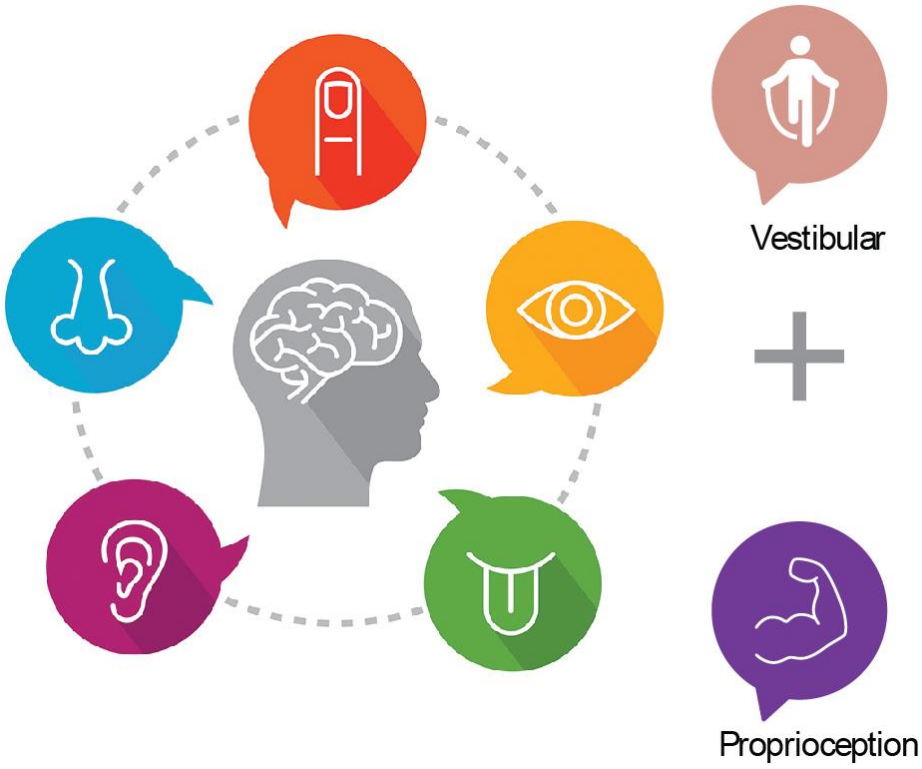
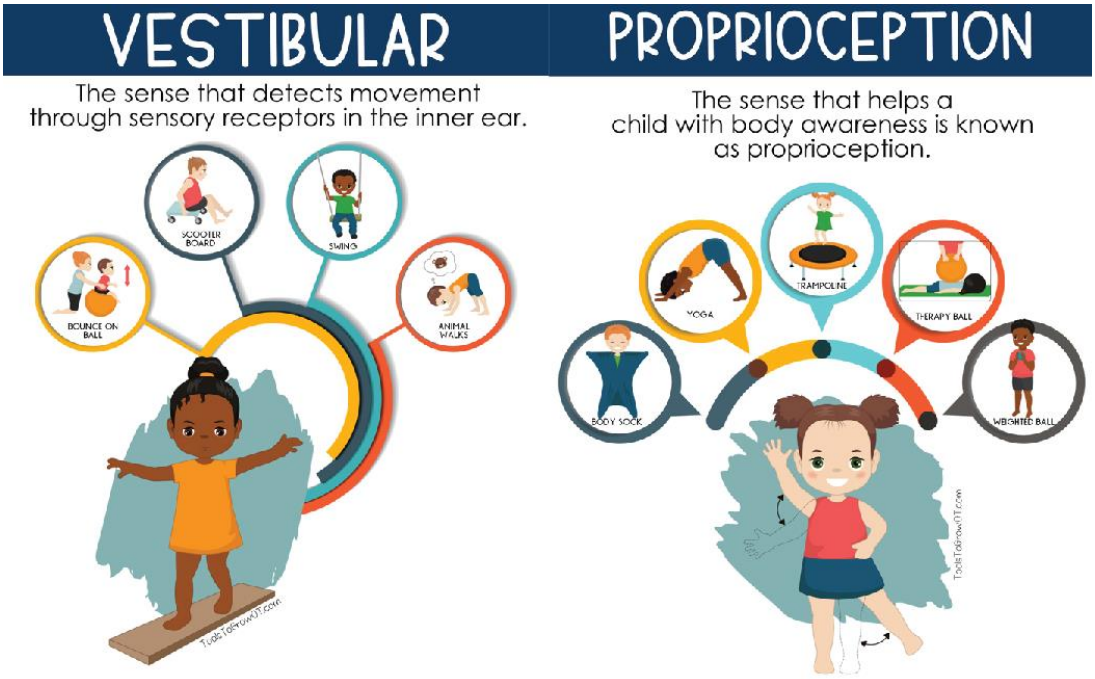


Figure 8. Tools To Grow, Sensory Integration: Vestibular and Proprioception



Active Seating

Active seating has made a wide appearance in educational settings as they are often used for accommodating students who need more stimulation. This returns to the idea of sensory integration of all our senses. Our five senses (sight, taste, sound, smell, and touch) as well as our vestibular and proprioceptive senses are responsible for our body's ability to function.

With this, active seating has become popular because of its ability to make all our senses work together. Some of these alternative seating types include:

1. Cantilever Chair
2. Gaiam Ball Chair
3. Kneeling Chair
4. Swivel Stool

Figure 9. Joyner, Best of Active Seating

In 2003, the American Journal of Occupation Therapy published a study that found that students using ball chairs were able to focus better and their productivity improved (Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J., 2003). This same idea was confirmed by the Mayo Clinic in 2007. Children who can move more, and therefore burn excess energy were more attentive than those who did not have the ball chair. By bouncing and moving while working, students were able to stimulate their brains, and their cognitive performance improved (Lynch, n.d.).

Since active seating is an accommodation that is often used in different learning environments, this is something that will be explored more in my research.

Environmental Features

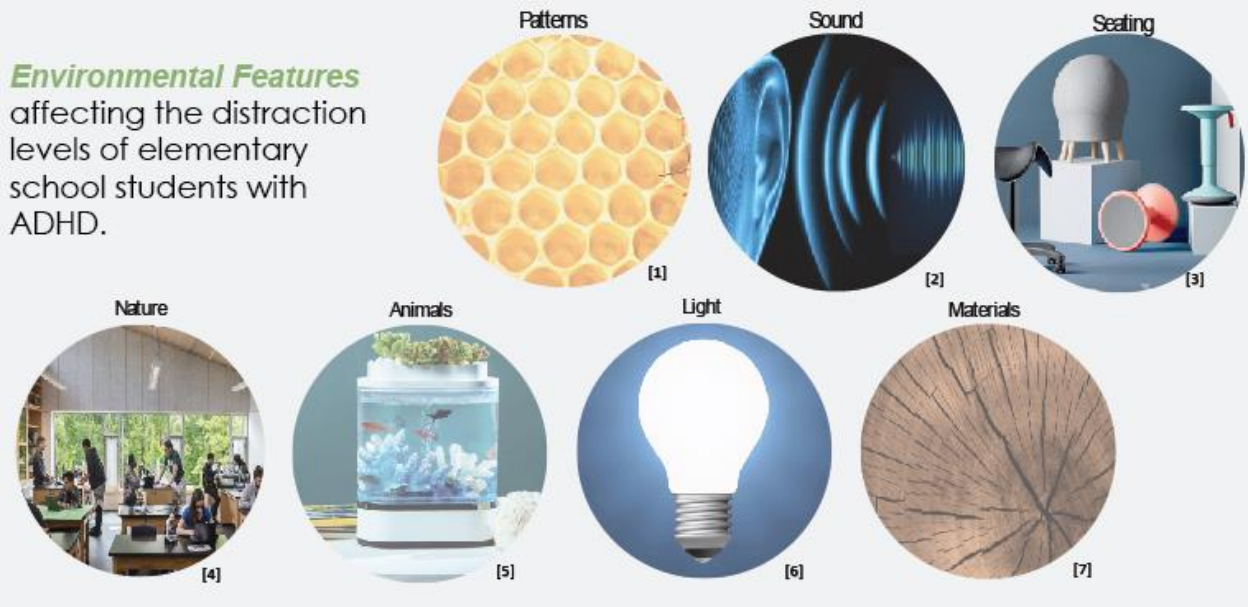
Special population is a term that is generally used to refer to a disadvantaged group (US Legal, 2021). Research suggests that designing for inclusivity in the classroom is key for special

populations (Tufvesson & Tufvesson, 2009). Between the social, physical, and individual features for every individual, there are several design attributes pulled from these that will allow students to have the optimal learning environment. Research done by Tufvesson and Tufvesson (2009) in Sweden looked at three special populations within an elementary school and evaluated the positive and negative impacts of the existing classroom designs.

Of the three populations, one was focused on students with ADHD. Through a nine-item questionnaire about the classroom spaces using the Human Environmental Interactive model (the HEI model), they evaluated the positive and negative influences that environments had on the children. The questionnaire was given to 125 personal assistants and teachers from the Region of Skåne. The findings suggested several classroom accommodations. Firstly, learning environments for students who have ADHD should not have several doors or windows because any direct views of a schoolyard or direct daylight had a negative impact on the student's ability to concentrate.

After interviewing teachers and evaluating the survey, they observed closed shelf storage was received better by the students than open shelf storage, as seeing a mess (i.e., clutter) in a drawer or on a shelf can create distractions. Other negative influences on the students were background noise and sound filtration, and the presence of several computers within a space. Positive influences on students' attention within their learning environment included smaller rooms, personal seating or a purpose-suited place, plants, and a one-to-one teaching style (Tufvesson & Tufvesson, 2009).

Figure 10. ***Environmental Features***



CHAPTER III: EXISTING SITE

Location, History, and Demographics

Ellsworth Elementary School is nuzzled between mountain ranges and directly adjacent to the Columbia River. This Pacific northwest school is located in the southern region of Vancouver, Washington.

Ellsworth Elementary is a Title I school. According to PSNC, a Title I school is a "federally supported program that offers assistance to educationally and economically disadvantaged children to ensure they receive an equitable, high-quality, well-rounded education and meet the school system's challenging academic standards" (PSNC, 2020). With this, 61 percent of the students enrolled are economically disadvantaged and require assistance.

Ellsworth Elementary houses approximately 380 students, and there is a 13:1 teacher to student ratio. Roughly 49% of the students are female, and 51% of the students are male.

In 2020, I was able to visit the site, as my aunt, Nancy Frank, is the Associate Principal. After touring the building, she mentioned that something they were lacking in administrative space, and space for their staff who are new mothers to nurse.

Another concern was accommodating students who are neurodivergent. Unlike neurotypical students, there are additional steps that have to be taken to ensure success with students who have ADHD. Alternative teaching methods were already implicated, however, little to nothing was done to change the students' immediate surroundings. Of the 380 students, %37 have learning disabilities. With this, designing to ensure the best learning environment was vital.

Figure 11. Great Schools, Ellsworth Demographics

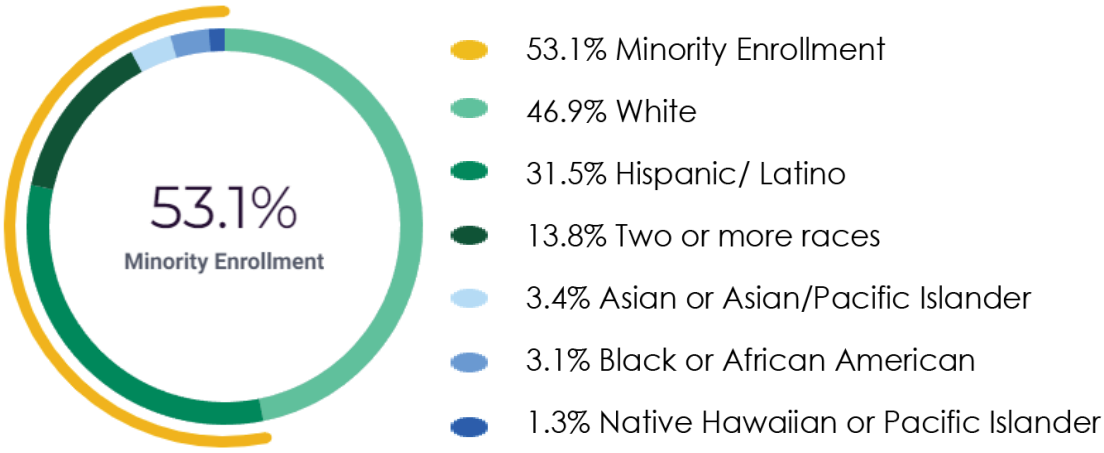
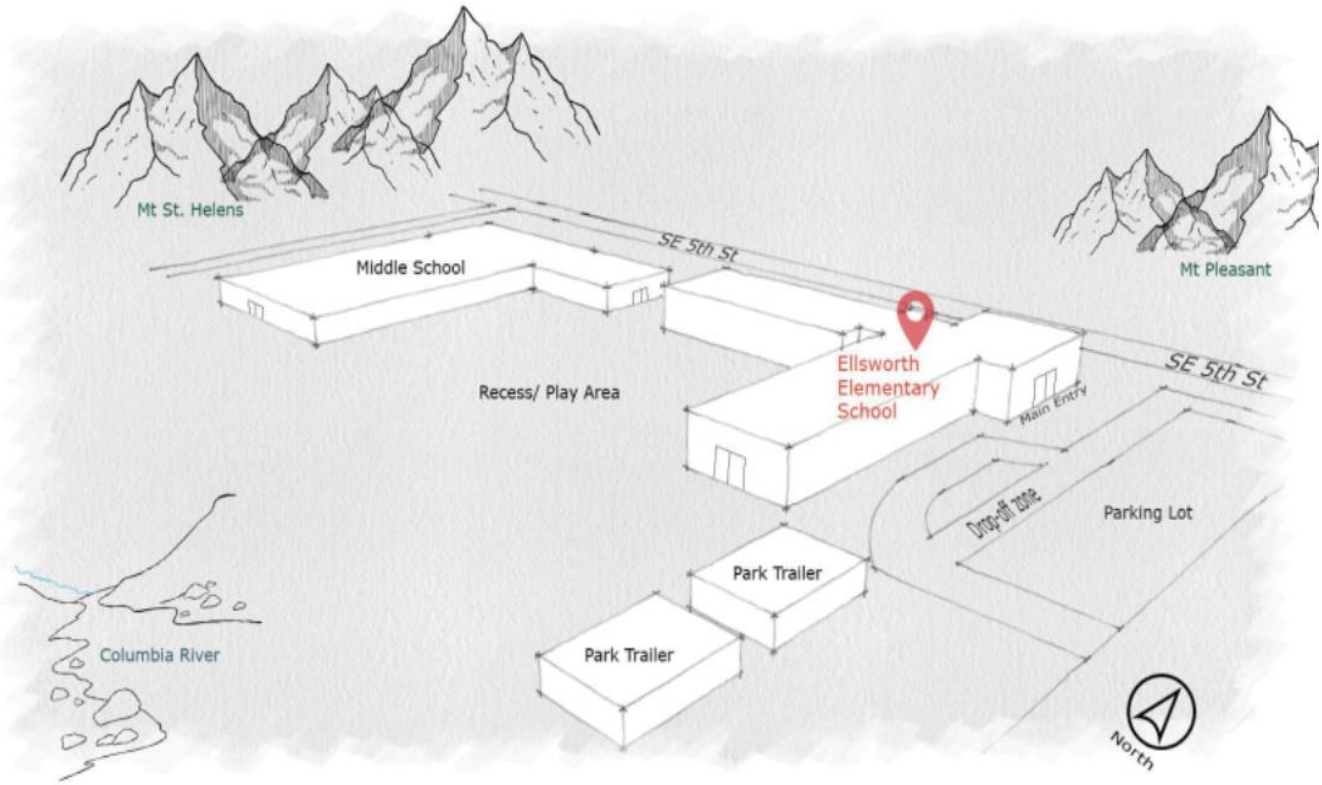


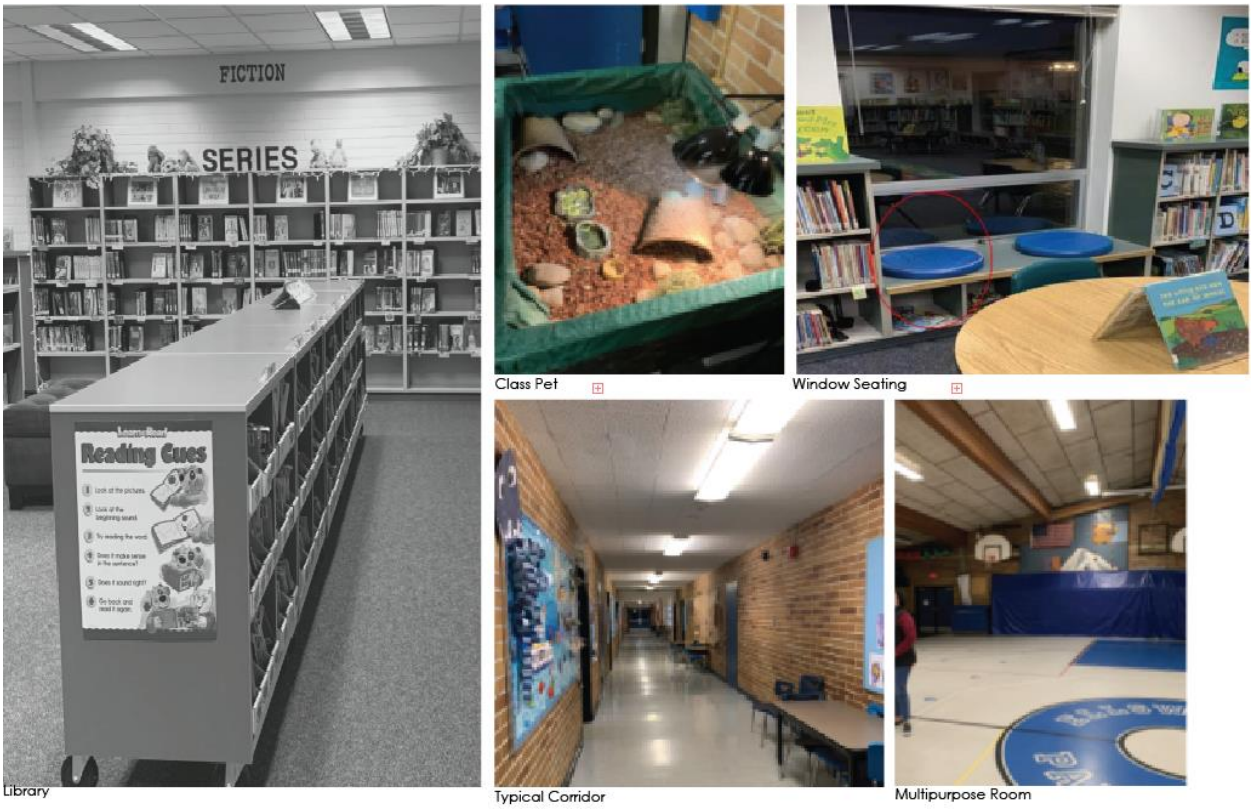
Figure 12. *Site Map*



Site Visit

While visiting my Aunt Nancy in Vancouver, Washington, I was fortunate enough to receive a private tour of Ellsworth Elementary School. She walked me through all of the spaces, and I took photographs to document existing conditions.

Figure 13. ***Site Imagery Part One***



Each space in Ellsworth had some elements that my Aunt said would be worth keeping. For instance, the "Peace Corner" is a place for students to regain composure if they are having trouble focusing in the classroom. Another element was the active seating and daylighting in each space. She mentioned that their administrative areas were not large enough and that adding a sensory space and a mother's room would be ideal in a new school.

Figure 14. ***Site Imagery Part Two***

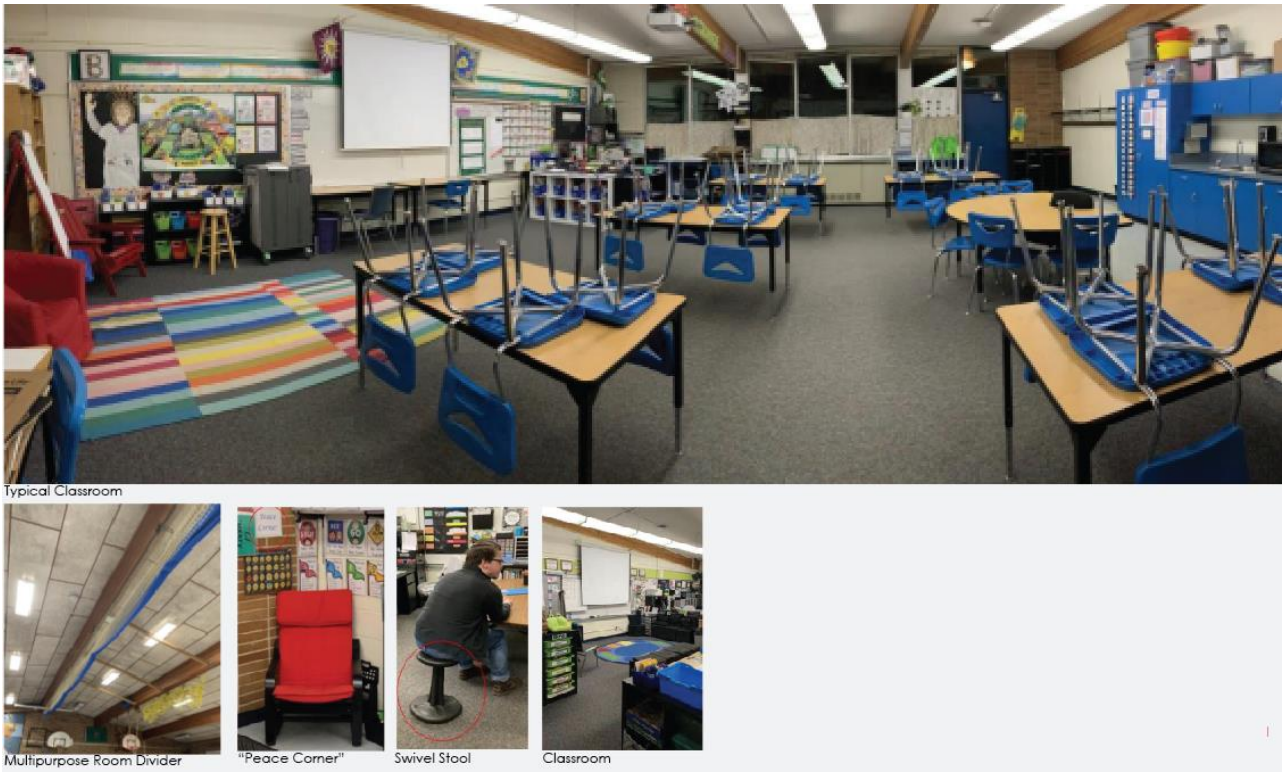
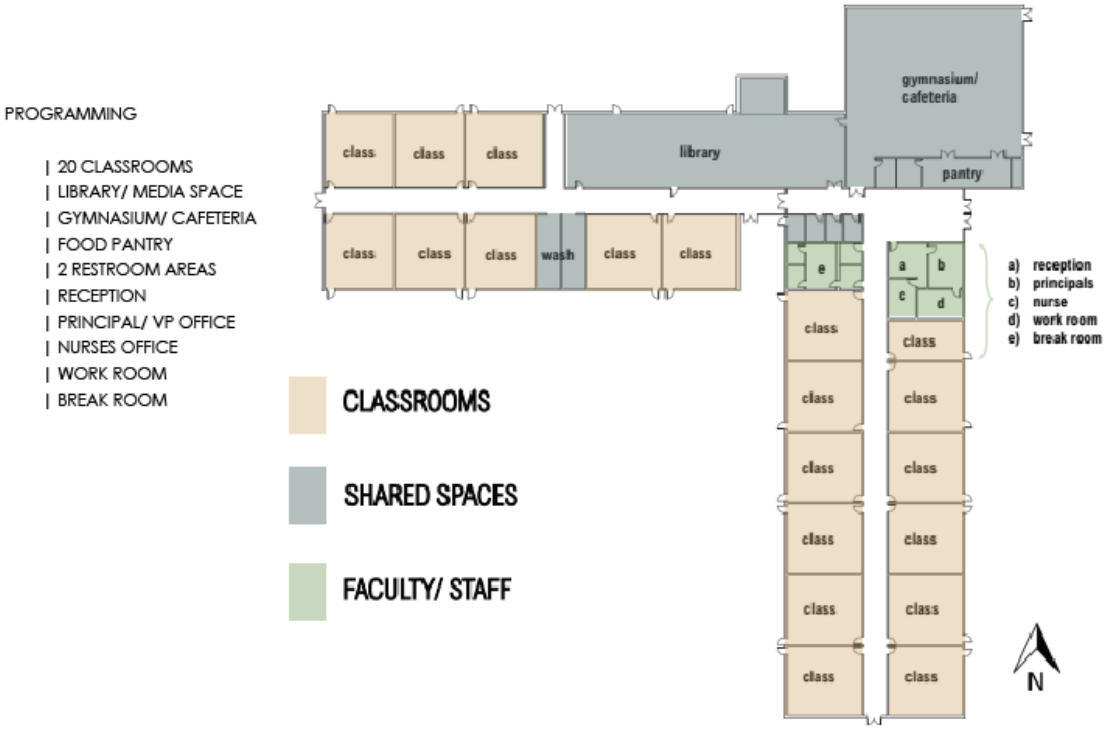


Figure 15. ***Existing Floor Plan***



Renovation Requirements

Figure 16. ***Renovation Requirements***

PROGRAMMING

- 12 CLASSROOMS
- LIBRARY/ MEDIA SPACE
- GYMNASIUM/ CAFETERIA
- FOOD PANTRY
- 3 RESTROOM AREAS
- RECEPTION
- PRINCIPAL/ VP OFFICE
- COUNSELOR'S OFFICE
- NURSES OFFICE
- WORK ROOM
- COLLABORATION SPACES
- SENSORY ROOMS
- MOTHER'S ROOM
- BREAK ROOM

Ellsworth Elementary Exterior (2020)

CHAPTER IV: PROJECT ONE

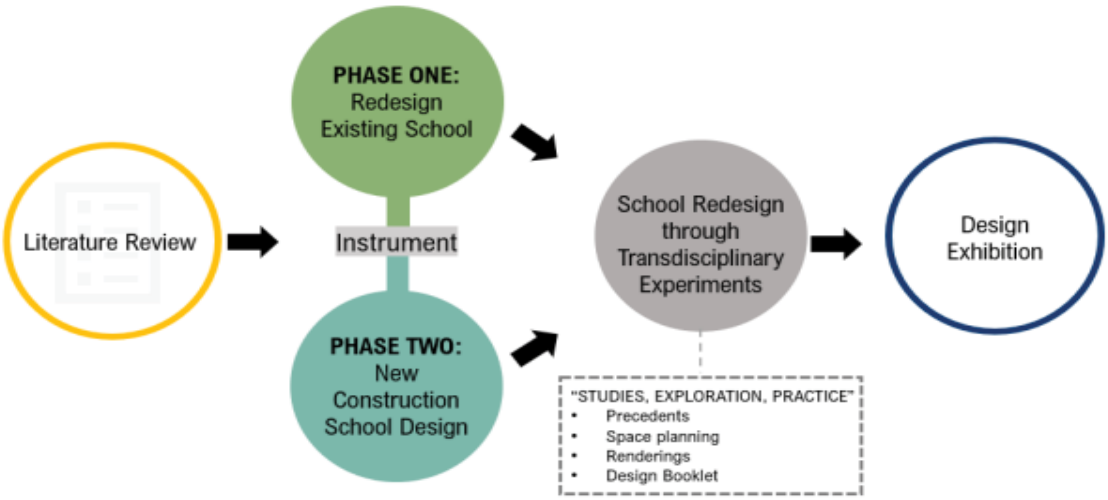
Project Overview

The first project is the redesign of the existing traditional school building. In America, the average cost for building a new construction grade school is $16,269,543 (Spaces4Learning, 2015). With this, it was important to explore how existing school buildings could be re-imagined and retrofitted to better suit those with ADHD without demolishing or rebuilding their structure.

By using the earlier stages of this project as a precedent through the application of different environmental features, this serves as the framework for the second stage of this project.

The second stage acts as conceptual ideation for how this project may be further developed as a new construction school design. By taking away the interior elements and focusing solely on the bones of the school, this allows for expansion through speculative methods in the field. By starting from the ground up with a new construction school, all aspects of the building can consider the design features that could not be fully explored in the earlier phase of this project. This will allow for further growth and development in the future.

Figure 17. ***Project Timeline***



The process employed during the second phase of the first transdisciplinary project will be visual representations of the space through multiple forms of exploration. Through conceptual renderings, this phase will demonstrate how schools can creatively approach designing for students with ADHD. The second part of project one will be a school redesign that will show an understanding of how to apply environmental features for students with ADHD in a new construction grade school.

To summarize, the purpose of this study is to evaluate and determine design strategies regarding common environmental features in the classroom for students with ADHD.

The study practices speculative design to gain insight into how a school design can allow those with ADHD to thrive. Through precedent studies, space planning, floor plans, renderings, and a scaled model, this project will exhibit a non-traditional way to design an elementary school.

In conclusion, the research aspires to benefit the ADHD learning community as well as provide design strategies for eliminating distractions. Through a speculative /quantitative approach, the study will seek out design differences and solutions that may be used to positively impact ADHD students' ability to focus.

Precedent Studies

The following are questions I asked a friend who teaches 3rd grade at an elementary school.

1. What grade level do you teach?
2. Are you allowed to decorate your room however you like? If yes, how do you approach it?
3. What are some of your favorite areas or teaching tools in your classroom?
4. What areas are your least favorite?
5. Do you have to cater to students with ADHD or other learning disabilities in your classroom?
6. What are some of your students’ favorite things about your classroom?

7. Do you have alternative seating areas within your classroom (ex. rug, stools, bean bags, etc.)?
8. Do you feel like there is sufficient daylighting in your classroom?
9. Have you noticed students getting distracted by any colors, objects, or areas in the classroom?
10. Do outside noises (i.e. hallway noises, or outdoor) ever distract you or the students from getting work done?

Figure 18. ***Interviewing an Elementary School Teacher***

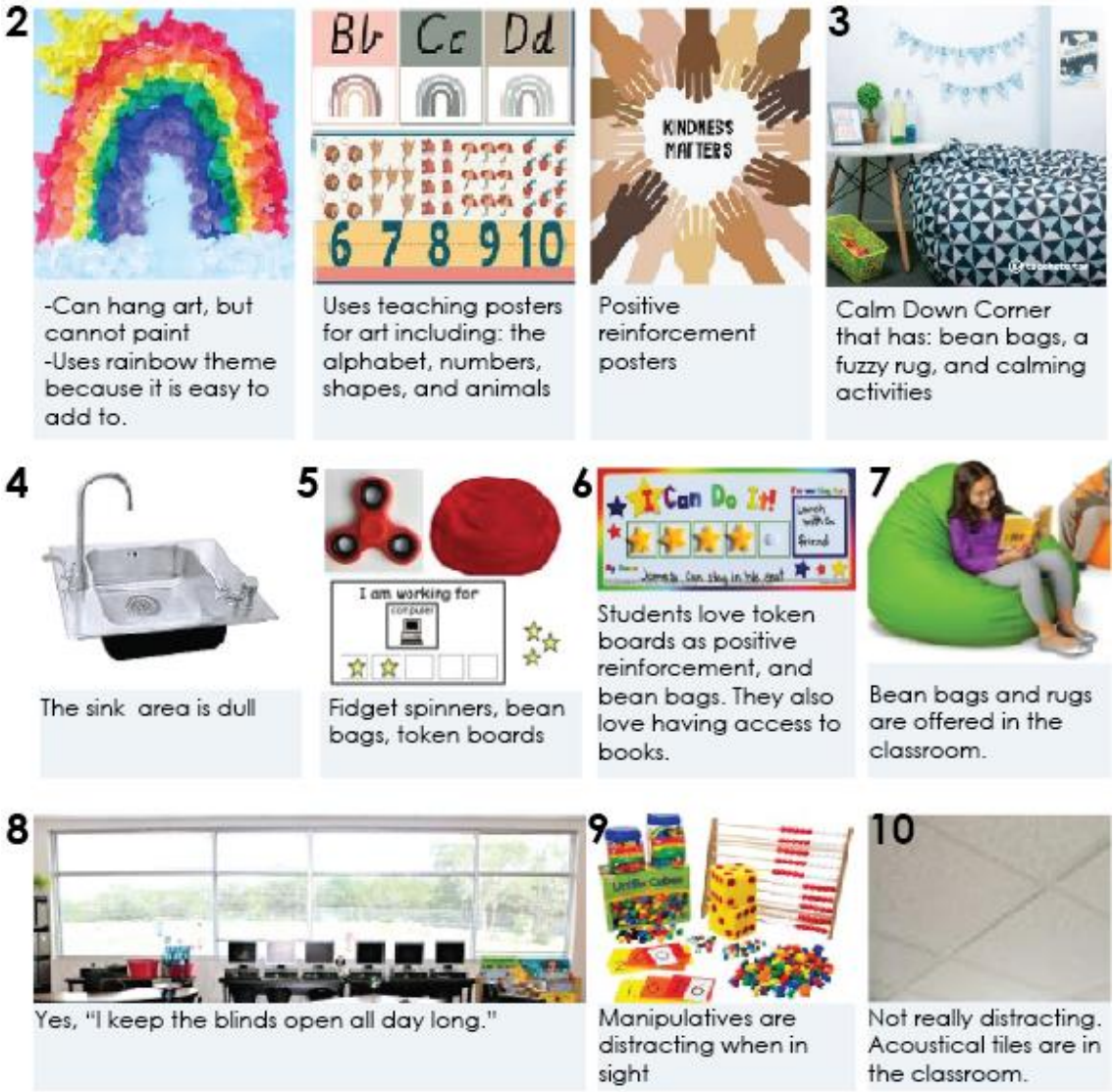


Figure 19. ***Charter Oak International Academy Precedent***

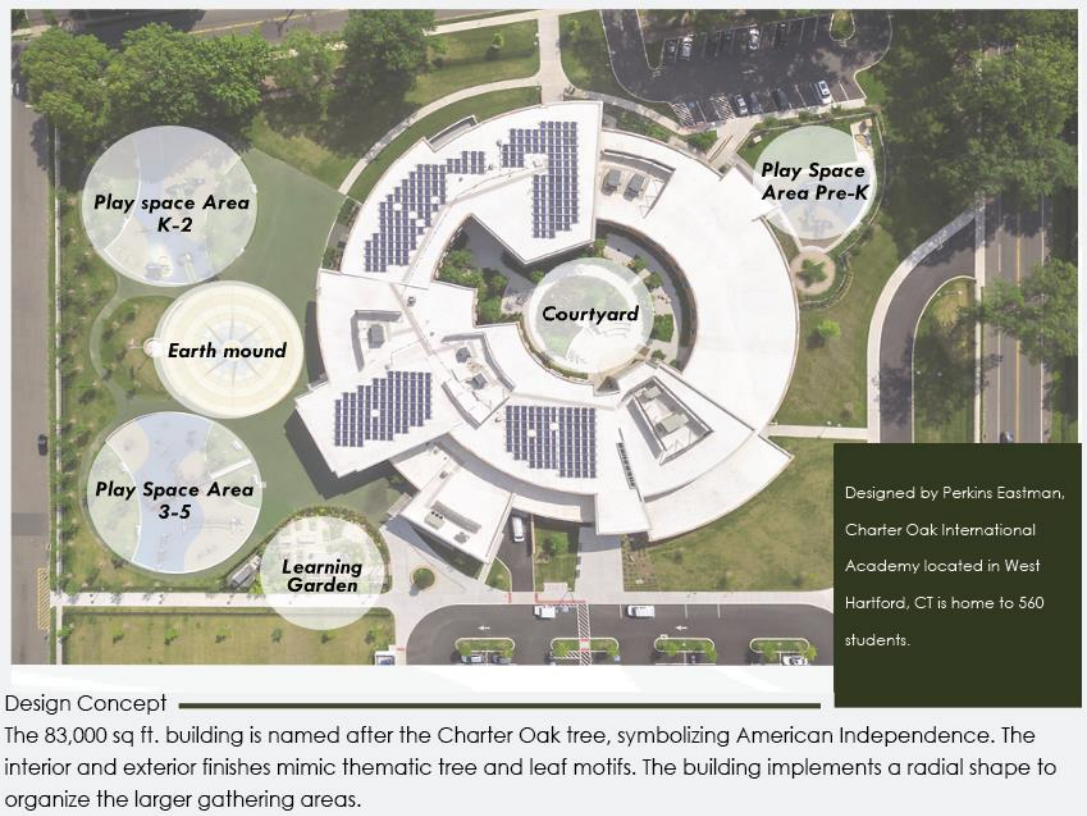


Figure 20. ***Charter Oak International Academy Part Two***

Figure 21. ***Charter Oak International Academy Part Three***

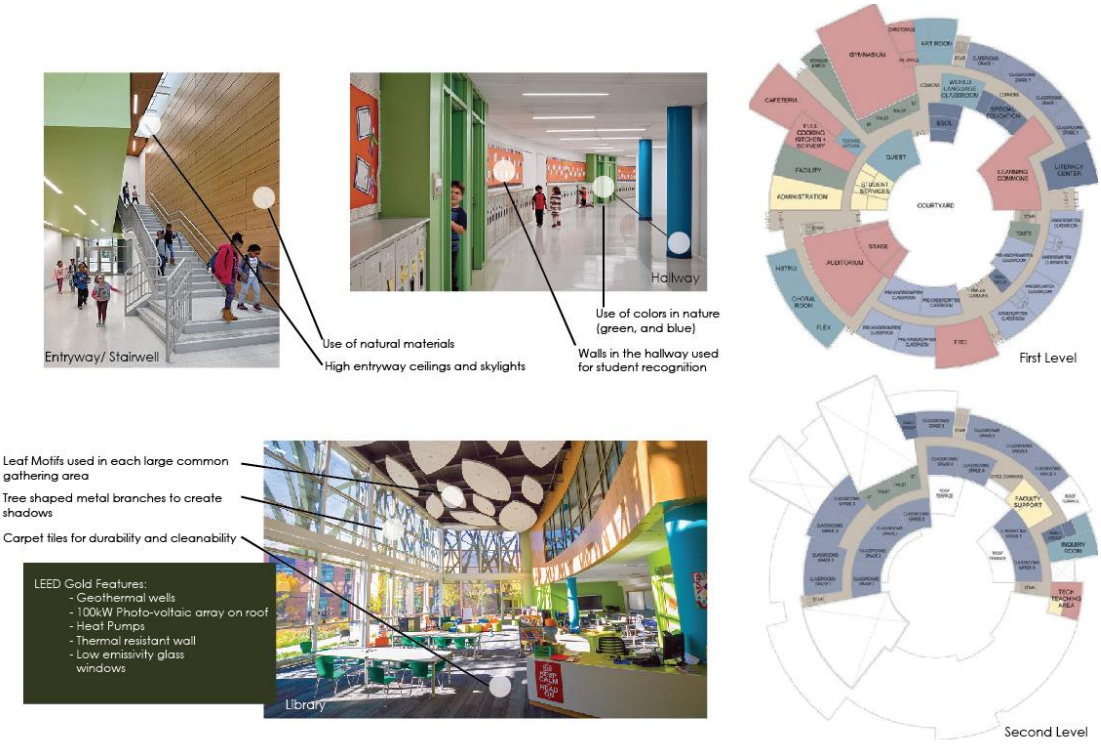
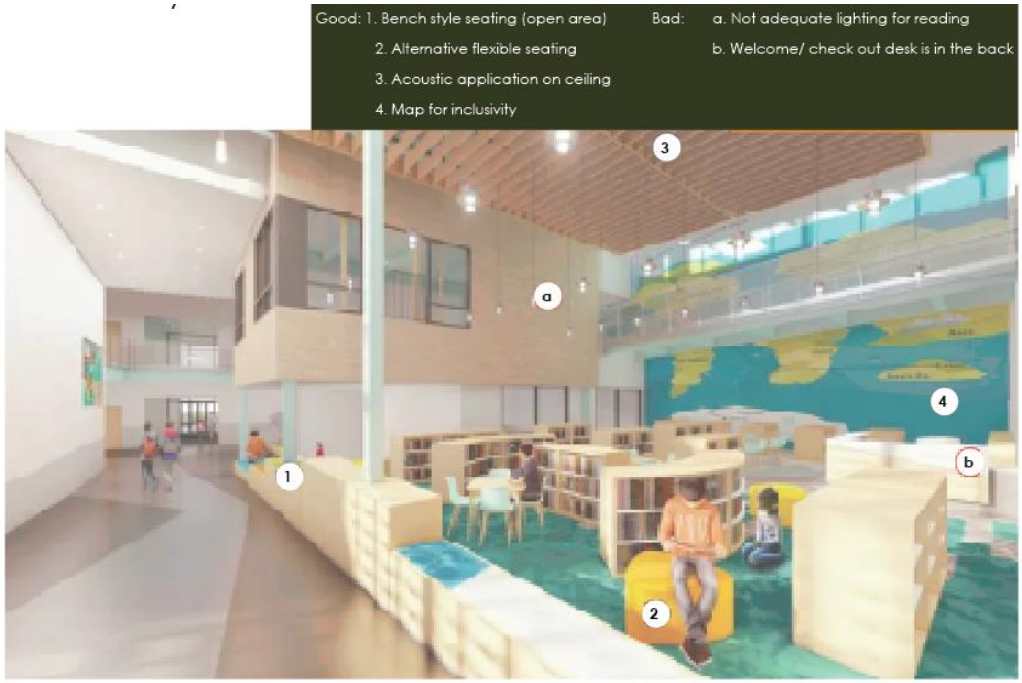


Figure 22. ***New Hildreth Elementary School***



Design Concept

The 85,200 SF building was designed to accommodate a state-of-the-art STEM school. The project site, presents an opportunity to create a school for 21st century learning that meets the educational vision of this high-performing school district while also respecting the character and values of the Town.

Figure 23. ***New Hildreth Elementary School Part Two***

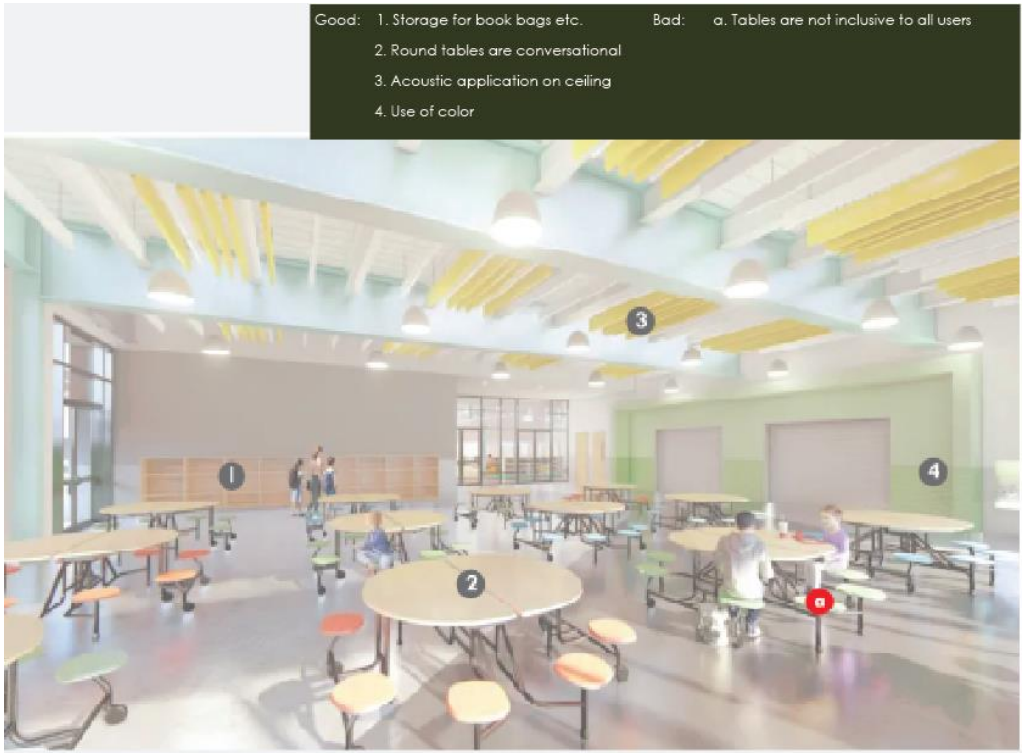
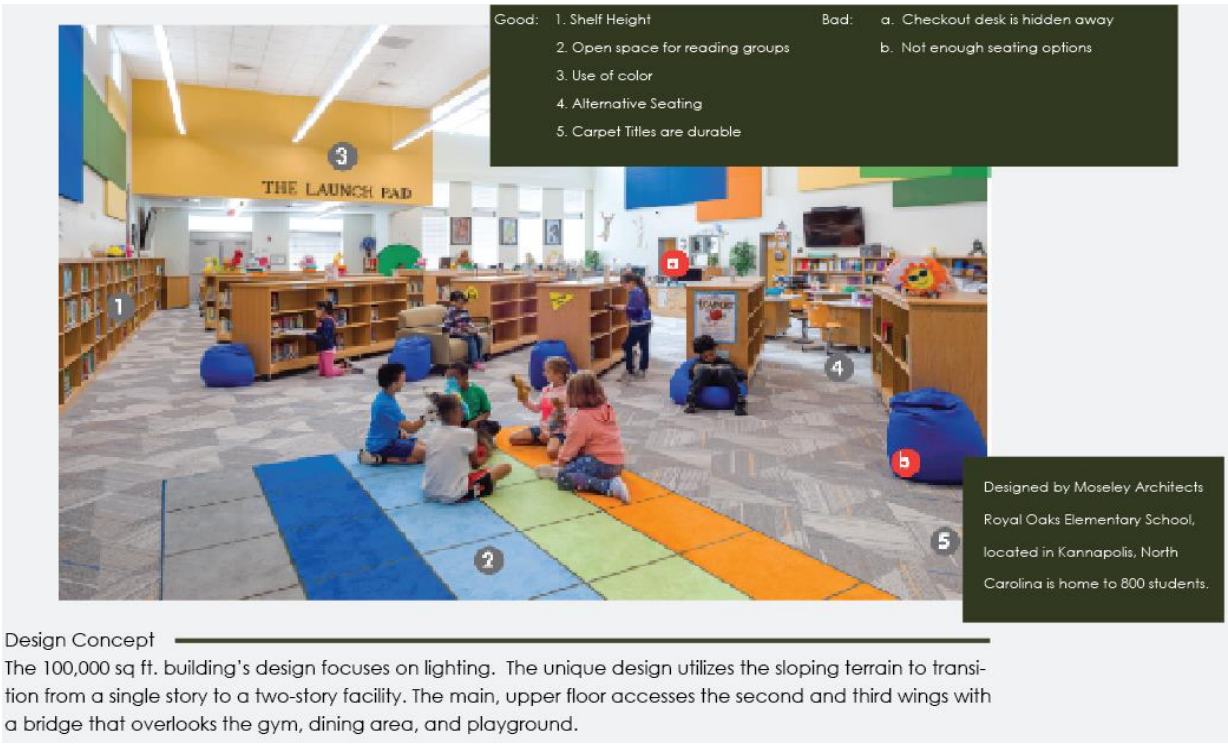


Figure 24. ***Cherry Park Elementary School***

Design Concept

The 71,422 sq ft. building was designed to consider three language immersion programs. Merging these programs at a central location fosters bilingualism, bi-literacy, and bi-cultural awareness. The school promotes inclusivity through flexible furniture for collaboration, shared classroom doors, and signage throughout.

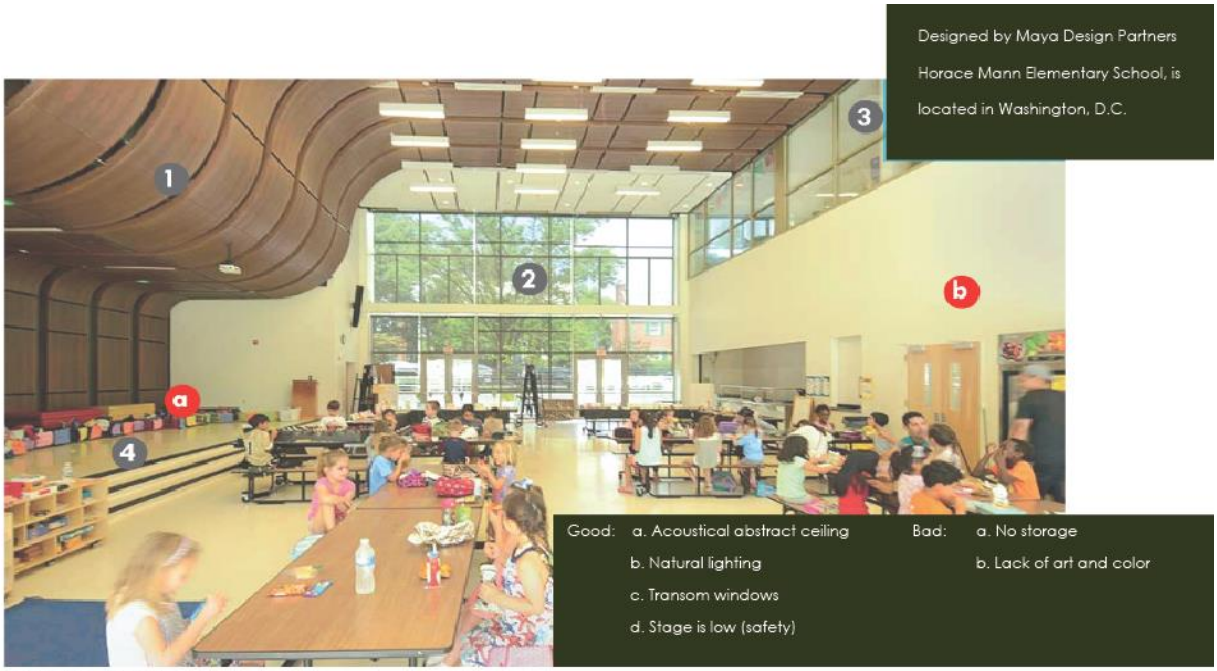
Figure 25. ***Royal Oaks Elementary School***



Design Concept

The 100,000 sq ft. building's design focuses on lighting. The unique design utilizes the sloping terrain to transition from a single story to a two-story facility. The main, upper floor accesses the second and third wings with a bridge that overlooks the gym, dining area, and playground.

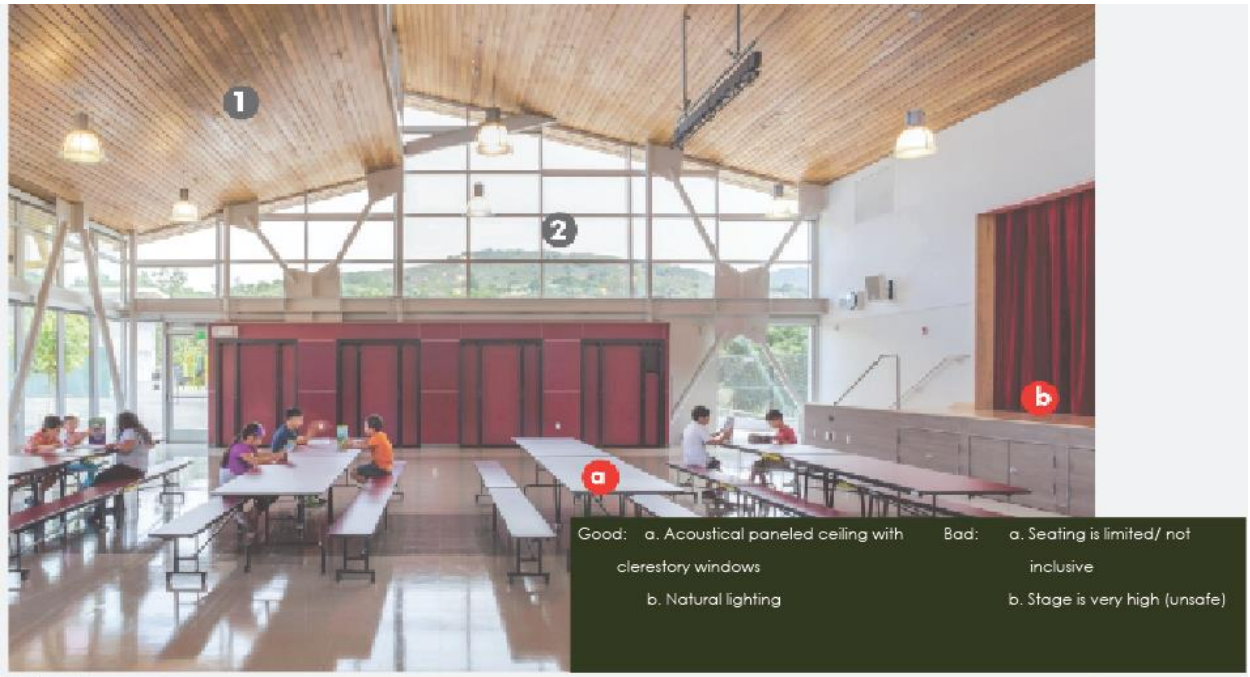
Figure 26. ***Horace Mann Elementary School***



Design Concept

The 17,000 sq. ft. building featured a fully renovated Multipurpose Room and classroom spaces.

Figure 27. ***Horace Mann Elementary School Part Two***



Design Concept

The multipurpose room features clerestory windows, room for storage, and floor to ceiling windows.

Figure 28. ***Vernon Elementary School Outdoor Classroom***

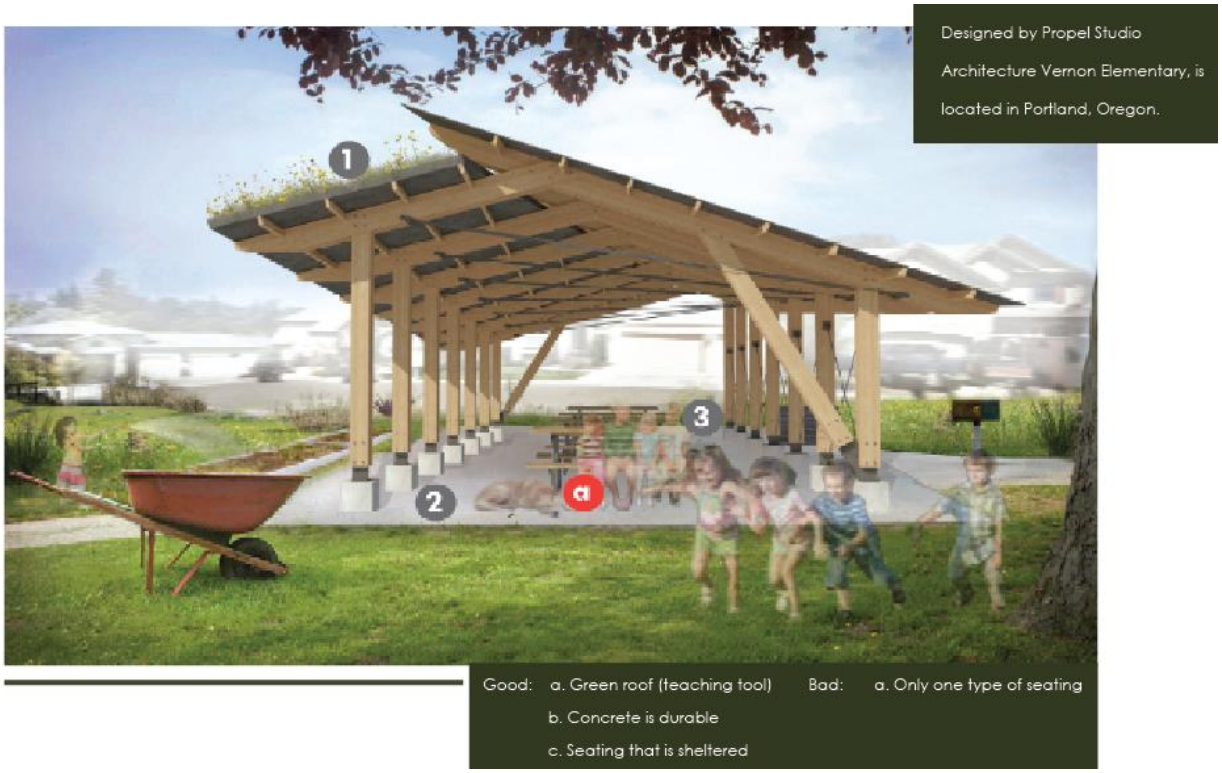
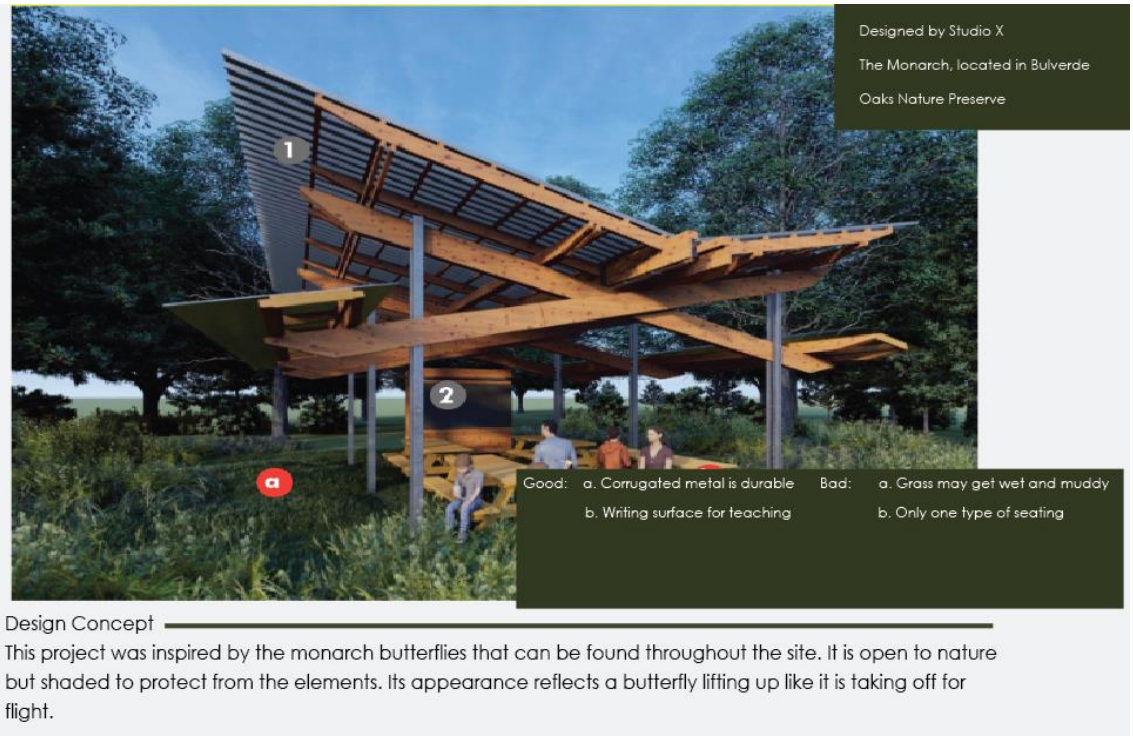


Figure 29. ***Bulverde Oaks Nature Preserve***



Design Concept and Goals

Ellsworth Elementary School will be reminiscent of a walk through the forest. Surrounding geographical elements will be mimicked using organic shapes within the furniture pieces, and a selection of natural finishes.

Figure 30. ***Design Concept***

Through these different elements, the goal is to design a school to be inclusive for all cultures, adaptable for students with ADHD or other learning /physical disabilities, and inspirational for learning.

Schematic Design

Figure 31. ***Schematics***

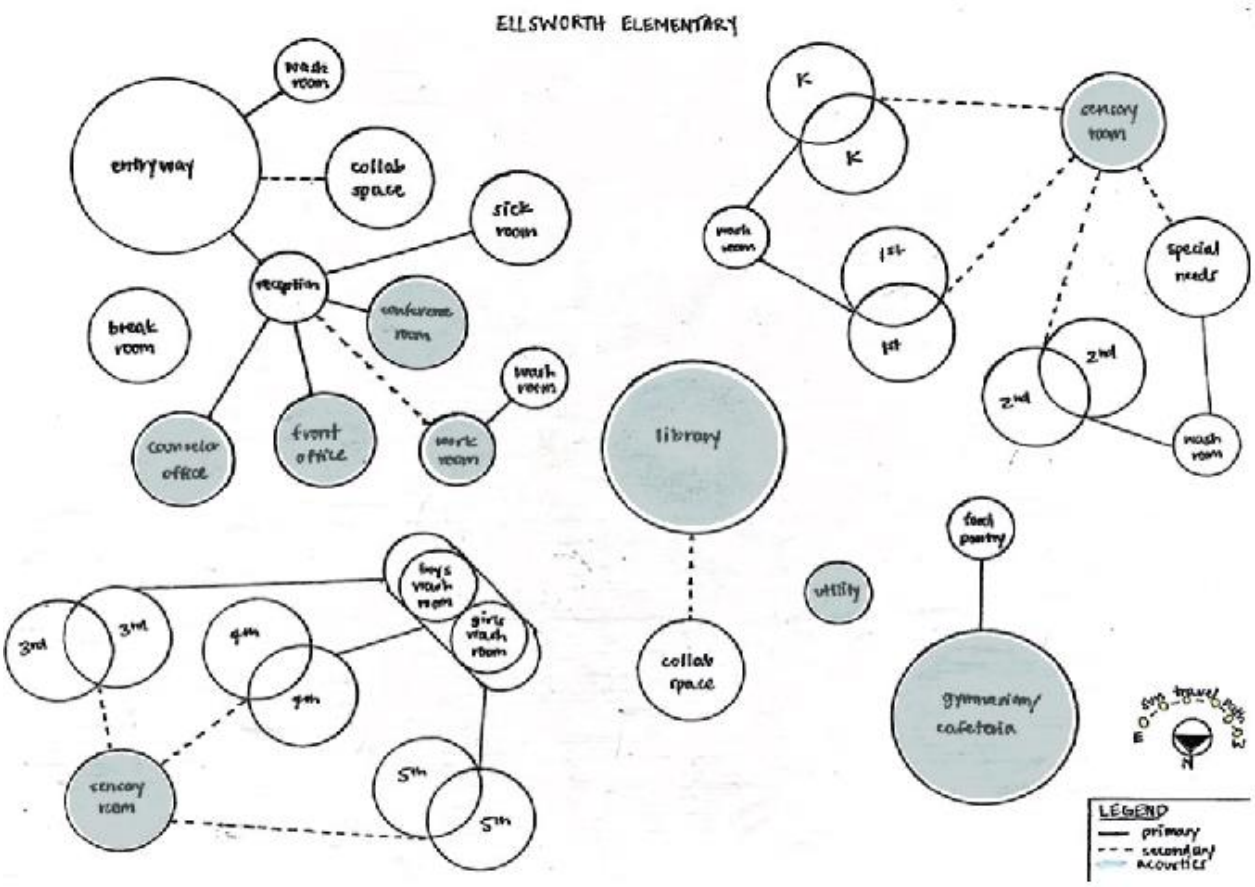
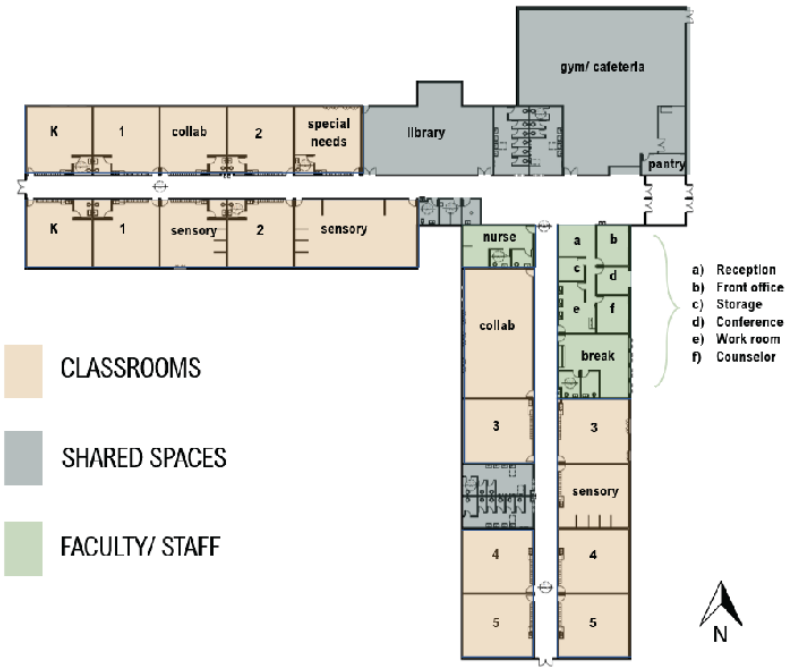


Figure 32. ***School Requirements***

Ellsworth Elementary School requirements met:

- 12 CLASSROOMS
- LIBRARY/ MEDIA SPACE
- GYMNASIUM/ CAFETERIA
- FOOD PANTRY
- 3 RESTROOM AREAS
- RECEPTION
- PRINCIPAL/ VP OFFICE
- COUNSELOR'S OFFICE
- NURSES OFFICE
- WORK ROOM
- COLLABORATION SPACES
- SENSORY ROOMS
- MOTHER'S ROOM
- BREAK ROOM

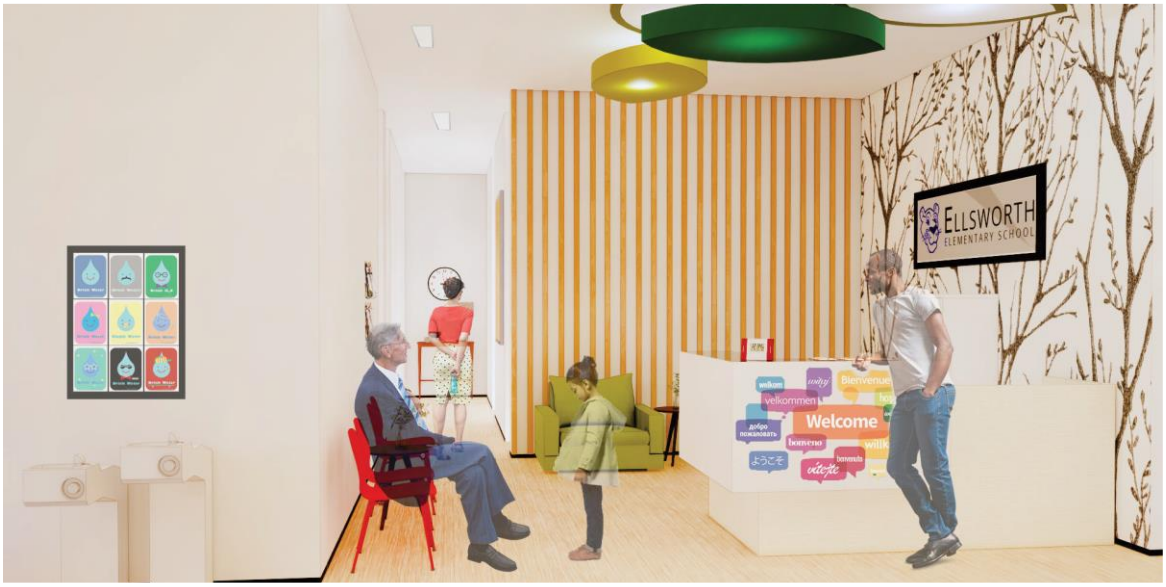


Design Development

Figure 33. ***Entryway***

As shown in figure 34, the entryway welcomes students through vibrant colors intertwined with nature evoking elements. Using texture and simple inclusive wayfinding, all students are able make their way to their classrooms.

Figure 34. ***Reception***



The reception area has different signage that is all-inclusive to the multiple ethnic groups represented at Ellsworth Elementary. The space offers lounge seating for parents and students who have meetings with the administrative faculty.

Figure 35. ***Corridors***

The corridors all have two floor materials following a “river-like” path to reflect the surrounding Columbian River. Through fun wayfinding and color-coded classroom doors, students can find their classrooms.

Figure 36. ***Restrooms***

The restrooms carry other elements from the corridors to create a cohesive look. With fun colors and signage, students of all ages and languages can understand that they need to wash their hands.

Figure 37. ***Mother’s Room***

Like most elementary schools, there are a lot of young mothers or nursing women who require a private space to pump or have time to themselves. The mother's room at Ellsworth acts as a serene environment where young mothers can come and close the curtain, put their feet up and relax. This is part of the WELL Building Standard (a standard that commits to our well-being in a space) (WELL, n.d.).

Figure 38. ***Multipurpose Space***

As most multipurpose rooms are noisy; this space required more attention to acoustical details. Through acoustical ceiling baffles, acoustical wall panels on the stage, and an absorbent cork flooring on the stage, the noise level should be reduced. The stage has a wheelchair ramp and is only 1'-0" off the ground. This is not too high for it to be a safety problem. Different mountain ranges surround Ellsworth Elementary School, therefore, the use of a mountain mural ties into the geographical location.

Figure 39. ***Library View One***

According to my aunt, the library is the second most used place in Ellsworth Elementary School. Color theory suggests that green is the best color to use for learning (Staff, 2015). With this, the space has green painted walls and a soft wallcovering with different colored trees. The shelving is low enough that teachers and staff can see over them to maintain visual contact with the students, and the tables shapes vary in biomorphic shapes. Additionally, active and alternative seating are used throughout.

In figure 41, you can see that the library overlooks the outdoor patio and offers a lot of natural daylighting. This is essential to all students learning environments, however natural daylighting is particularly important for those with ADHD or other mental disorders. The dropped ceiling in the center creates a more intimate area perfect for story telling or for someone to curl up and read a book in one of the bean bags.

Figure 40. ***Library View Two***

Figure 41*. Outdoor Classroom View One*

The outdoor classroom acts an area for all students to think more creatively and work their very best. According to Laura Thal taking a walk outside through nature can improve our ability to focus and our cognitive performance (Thal, 2014). This is especially important for neurodivergents.

Figure 42. ***Outdoor Classroom View Two***

The outdoor space has multiple seating areas. There are bleachers with a back on them for safety purposes, and a few picnic-style tables that have an opening on one side for wheelchair access. There is a projector that rolls up to either display a view of the mountains in the distance or can roll down for a lesson. The roof is a green roof, and there are rain barrels. Each of these components are great teaching tools for young children. Lastly, there is a mountain mural mimicking what is seen in the distance.

Figure 43. ***K-2 Classroom***

Kindergarten through second grade classrooms all require similar functions. Students who are younger tend to work better in group table settings. Each organically shaped desk fits next to another. With COVID-19 on the rise, having a desk arrangement that can be flexible is key. Students often prefer different seating types. There are two types of seating at the desks: active swivel stools, and standard desk chairs. This allows students to choose which they work best in. Manipulatives are important and having things out of sight is better for those with ADHD (Tufvesson & Tufvesson, 2009). Shelving units offer just that. There is a soft surfaced rug for reading time, and a quiet corner for times when students need to take time to themselves to relax and regroup.

Figure 44. ***3-5 Classroom***

Third through fifth graders require less group seating, as they are more likely doing work on their own. The layout of this classrooms allows for a flexible seating arrangement and offers different seating options like the K-2 classrooms. Each classroom has a cubby area for backpacks and other belongings to be stored out of the way.

Figure 45. ***Special Needs Classroom***

The special needs classroom is for students with any mental disorder causing them to require more one-on-one attention. This space has group seating areas, as well as more refuge and “calm-down” areas. Students with autism, down syndrome, or any other disorders may find themselves more irritable or can become more flustered while completing certain activities. With these areas of soft seating and a place for the students to relax, this enables them to take the matter into their own hands when they need time alone.

Figure 46. ***Collaboration Space***

The collaborative space enables a couple of classrooms to join to complete activities. With proper equipment (white boards, digital screen surfaces) students and teachers can collaborate on fun activities. There are multiple alternative seating types in this space that allow students to feel in control of their seat choices. Notice the positive reinforcement posters, as well as the other natural materials and acoustical ceiling that create a safe space. Large windows look out to nature.

Figure 47. ***Sensory Room***

The sensory room is the most important room for students who are neurodivergent. This area is for students who need more stimulation or less stimulation. Different manipulatives and open area for students to play is essential for creating a stimulating environment. The cubby-like angular spaces are for students who need to find refuge and take time to recompose themselves. Soft materials, such as bean bags, rugs, and other cushioned area create an inviting and safe space for students who are more likely to accidentally harm themselves. Each cubby has a sensory wall that comprises of different textures for students to touch and feel in order to stimulate their senses. Clerestory windows are implicated to give natural daylighting to the space without showing a distracting view of what is going on outside.

Reflection

During the design process, I was able to experiment and create spaces that essentially adapt to the existing environment. Through creative solutions, this school became a palette for innovative design and accommodations.

Since the school building was not demolished, the structure was rather upheld and used to retrofit these new spaces.

Key elements featured in the spaces that are not seen in most traditional school buildings are:

1. Simple design using minimal colors that do not cause distraction.
2. Areas for refuge for students who need to recompose themselves.
3. Alternative seating solutions in all spaces.
4. Access to daylight but limited access to distracting outside views.
5. A sensory room equipped with necessary manipulatives for stimulation and spaces for isolation.
6. A covered outdoor classroom with a view and fun learning tools.

This phase of project one is important for all the existing school districts in our country that do not have the money to begin a new construction project. To accommodate all students, and especially those with ADHD, learning disabilities or other mental disorders, this phase of my research can be implemented into most existing structures.

Through trial and error, most spaces were achieved by simple solutions that can be used and benefit schools across America. Upon completion of this first phase of project one, I wanted to explore conceptual new construction solutions that are intended to specifically accommodate students with ADHD. After working on these conceptual designs, it became apparent that the design conceptualizations are those that can be beneficial to all students.

Future Conceptualizations

After I had a better understanding about how to retrofit existing spaces to accommodate those with ADHD and other neurotypical students, I started exploring different solutions for new construction schools.

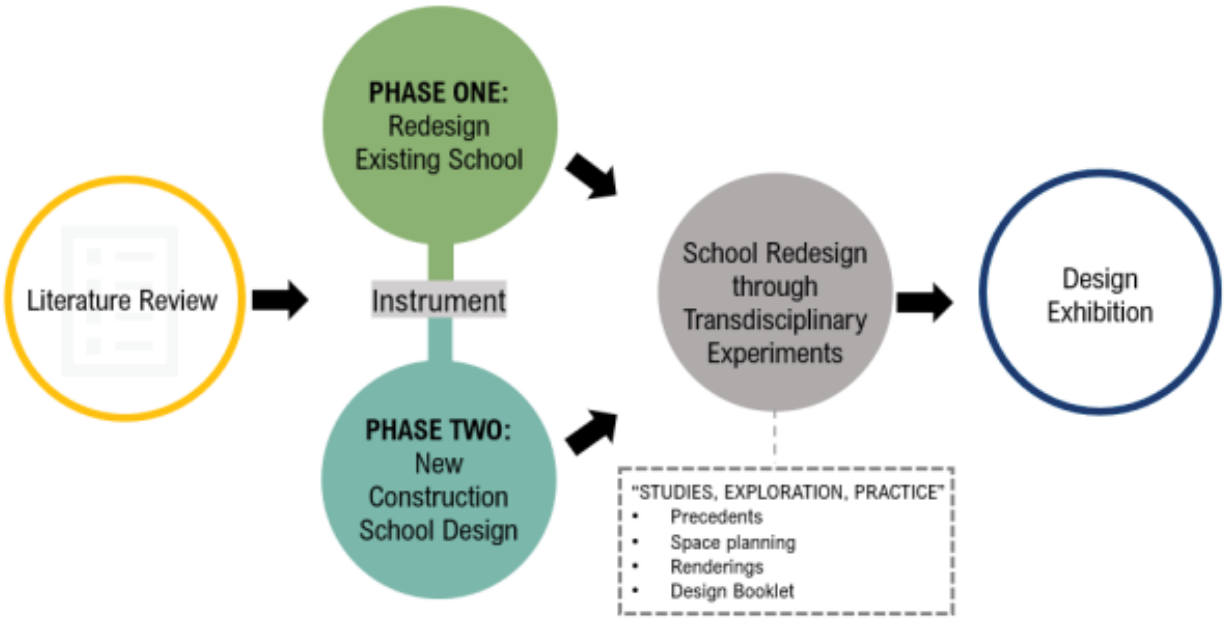
This led me to question: What if there was a school designed specifically for students with ADHD? How would this look? What are key environmental features that need to be addressed?

Through my research, and existing literature, I have found that three spaces or elements that are not addressed enough for students with ADHD are:

1. Daylighting
2. Transition Spaces
3. Exposure to nature

What would a school look like if its spaces were developed specifically to highlight these areas or elements?

Figure 48. ***Timeline for Phase Two***

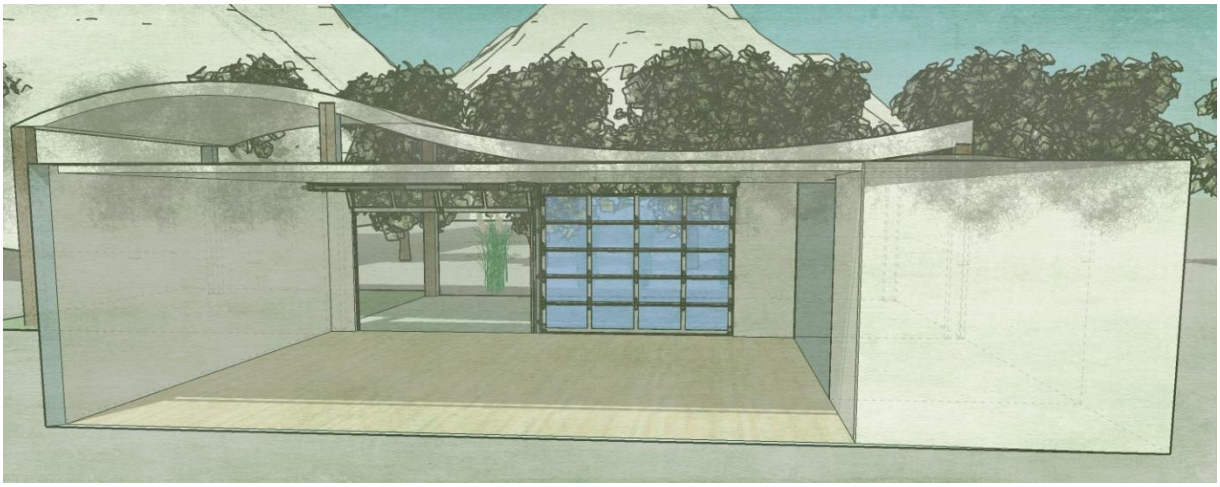


The process employed during the second phase of this transdisciplinary project will be visual representations of the space through multiple forms of exploration. Through conceptual renderings, this phase will demonstrate how schools can creatively approach designing for students with ADHD.

Figure 49. ***Conceptual Reception***

The reception or entry way areas are what welcome students and teachers into school every day. To make this experience fun and inviting for students and teachers, the ceiling is curved and there are cubbies in the wall for sitting. There are also two areas that act as peep holes out to the outdoors. Behind the reception is a green wall, and in order to get to class, students must walk through a greenhouse. Because Attention Restoration Theory suggests that exposure to nature can improve our cognitive performance, this is an innovative way for students to have this experience without going outside.

Figure 50. ***Conceptual Classroom***

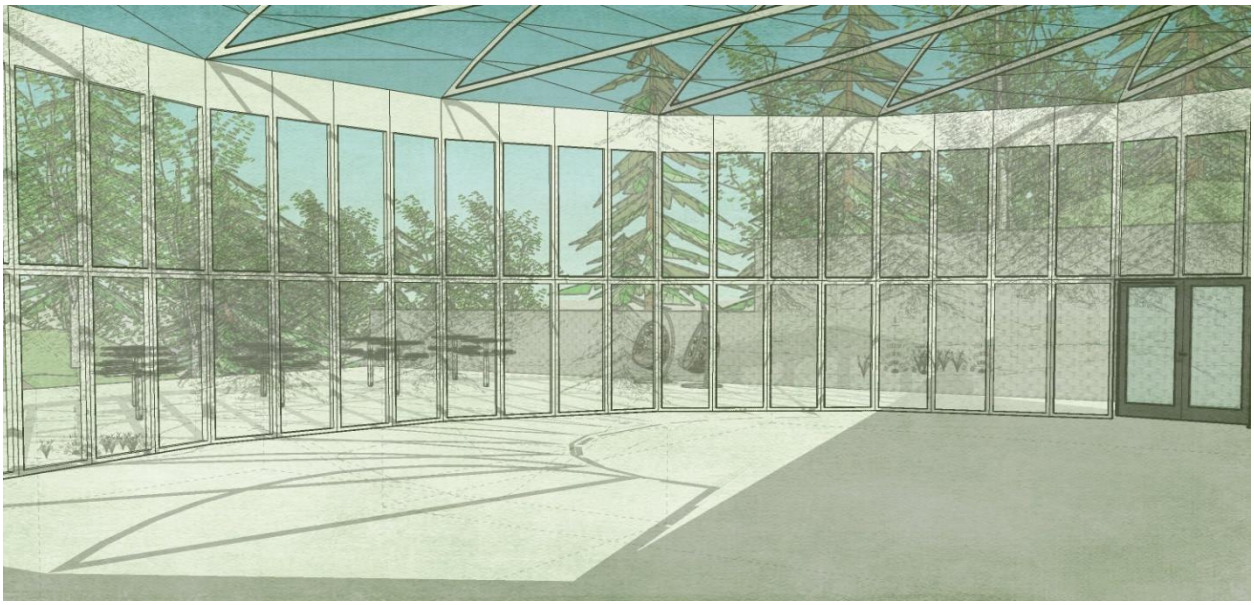


The classroom is the most important area when looking at school design. This is the area where students spend the most time. Daylighting and nature become the forefront of this design. Garage doors act as immediate access to nature. They can be closed or opened, depending on the weather or activities the students are working on. On the east side of this perspective, the ceiling drops and is an intimate environment for students to relax.

Figure 51. ***Conceptual Corridor***

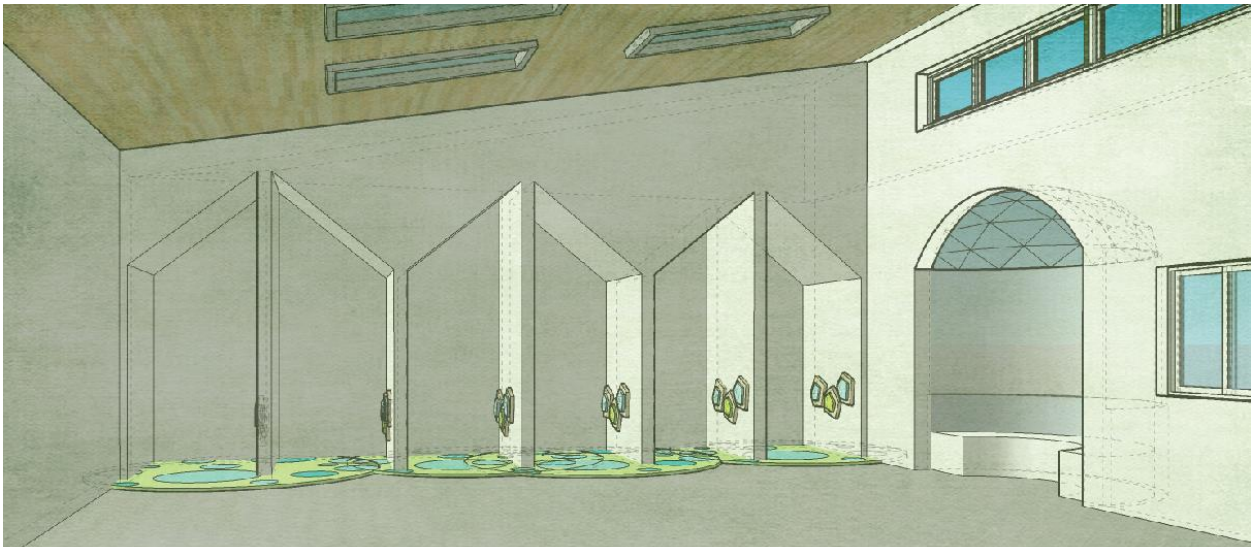
Transition spaces are often neglected in most school designs. For this school, transition spaces act as areas for exploration and stimulation. The use of natural textures, daylighting from the skylights as well as wrapped circular windows, and areas for regaining composure or mystery create a fun experience for all children. Each classroom is highlighted through a wooden wall application that continues across the ceiling. This grounds the space.

Figure 52. ***Conceptual Multipurpose Room***



The multipurpose room is a place for students to eat, play, and imagine. In this space, flexibility is key. This design gives students the chance to experience all their surroundings enveloped in a “bubble in nature”. Like fish in a fish tank, children can look outside through the roof, walls, windows, and doors all to experience the outside world. On the exterior of this space, there are picnic benches and nesting seats for students and teachers to enjoy the outdoors when weather permits.

Figure 53. ***Conceptual Sensory Room***



The sensory room acts as a place for students to either come for stimulation or for relaxation. Most sensory rooms are rather small additions to their surrounding environment. This sensory room is 900 SF and caters to children of all needs. The window seating acts as an area for children to look out at the natural surroundings. The skylights, clerestory windows, and standard double-width window provide daylight to the room. The cubbies on the south wall act as places for refuge.

Reflection

Both phase one and phase two implicated innovative design solutions for accommodating those with ADHD.

Upon completion of the second phase, I realized that the conceptual school design is something that could benefit everyone. Essentially, all humans require interaction with nature, daylighting, and some sort of physical and mental stimulation to work our best. By looking at phase two through a different lens than phase one, the solutions became more advanced and achievable through a new construction design.

My hope is that in the future, school designers and architects, teachers, parents, and even students can use this study and research to benefit them and their experience in the classroom.

No child should feel like an outcast, and with this project, I believe it is a step in the right direction to design an all-inclusive environment that everyone can enjoy.

I am grateful to have had the opportunity to work with such lovely mentors and peers throughout this process. Without all the guidance and feedback, this project would not have developed into what it is today.

CHAPTER V: PROJECT TWO

Overview

After researching and exploring the different existing options of alternative active seating, I wanted to try and come up with a new active seat.

Project two investigates the properties and motions that most active seats already employ, and fully reimagines these elements into a new design. Cantilever chairs bounce, The Gaiam Ball Chair bounces, the Kneeling chair enables different muscles in our back creating better posture, and the Swivel Stool swivels.

What kind of chair could I make that has not already been done? I decided to try and combine these motions all into one piece. In two phases, I first created the "Box Swing" That enables its users to swing/sway. In the second phase, I created the FlexiRocker which essentially enables its users to rock, bounce on the bungee seat, and use different textures for stimulation.

In the future, I would like to rethink this design to make it better suitable for classroom desk seating.

Figure 54. ***Wood Shavings***

Existing Seating and Prototype Development

Before creating a new piece, I had to consider cleanability, safety for young adults or children, and durability as this is meant to be placed in a school environment. Some desires for the chair were active elements such as rocking, bouncing, tapping, or stimulating different textures.

For my prototype, I designed the "box swing". This chair allowed its users to rock back and forth. After creating a 3d model and then building the box swing, I realized that the squared arms and back were quite uncomfortable.

Figure 55. ***Existing Active Seating Sketches***

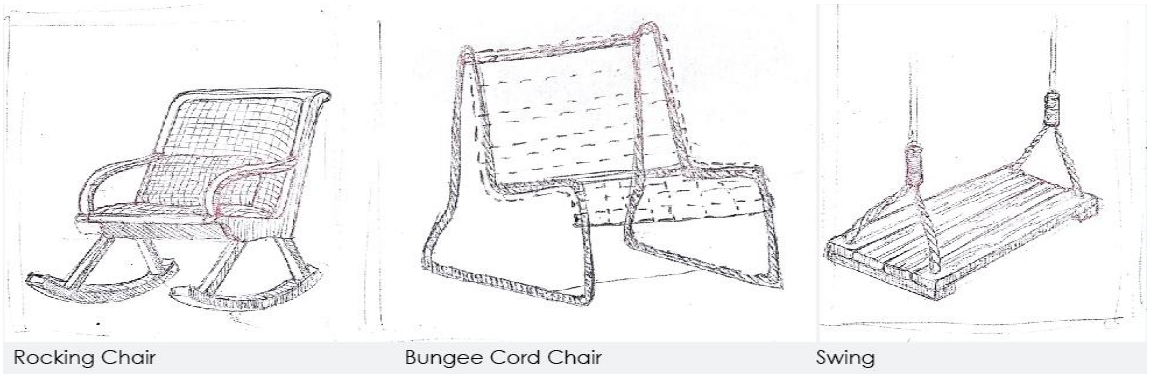
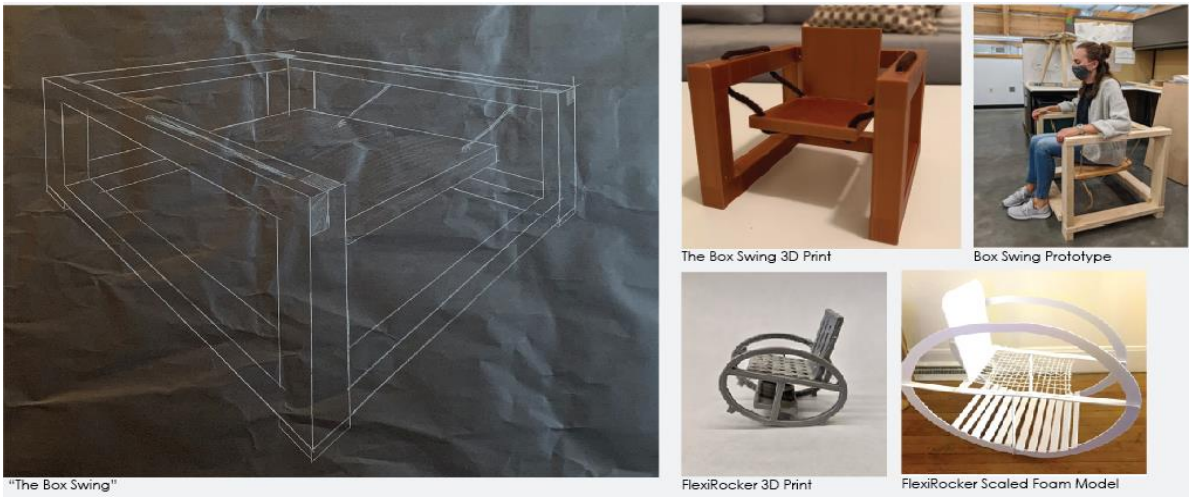


Figure 56. ***Prototype Development***



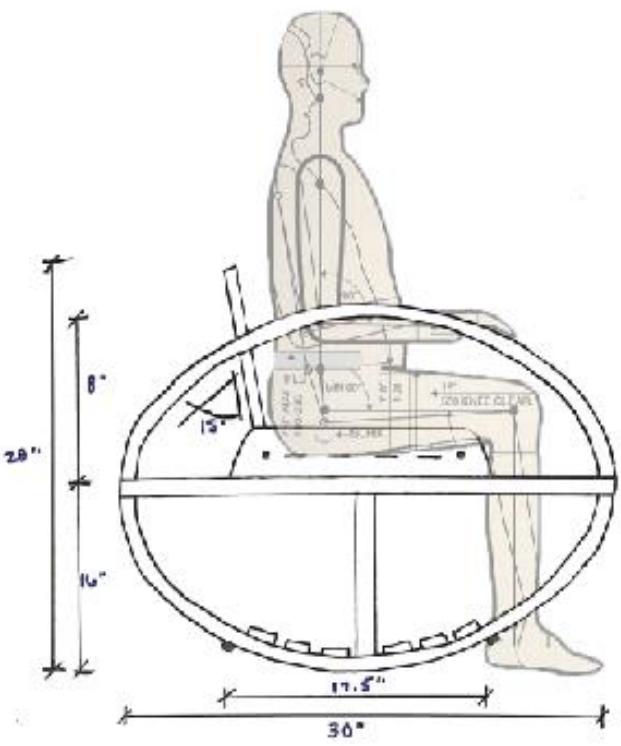
FlexiRocker Development

Following the design of the prototype for a "box swing" chair I developed the design further and created the FlexiRocker. To move forward I began to sketch existing chair designs and tried to combine them to create something innovative, after coming up with this new idea I 3D printed the design and then made a scaled white model. After researching and gathering information about the measurement of man, I was able to create the chair based on all of these ergonomical needs. These included the seat angle, seat height, seat depth, chair back height, and arm height.

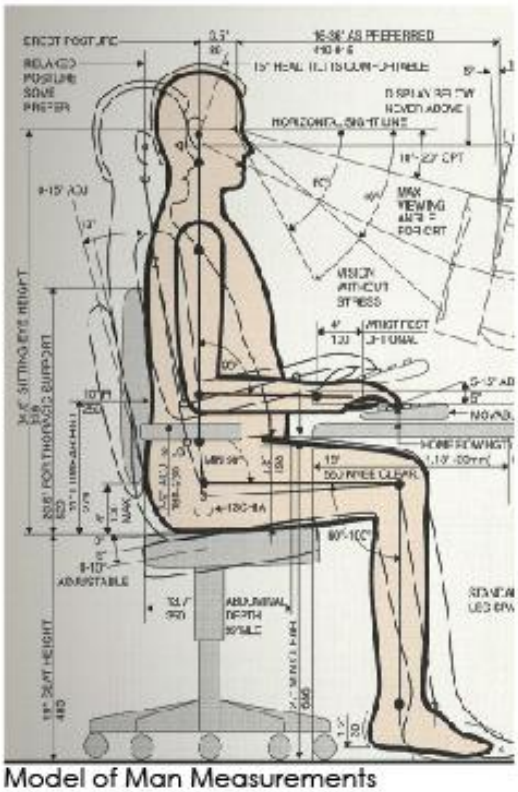
The next part of the process was building. I started by cutting, ripping, and laminating all the wood pieces into a semi-circular shape over a particleboard mold. This technique took a lot of precision and was the most difficult part of building the chair. After bending and assembling all the wood pieces, I weaved the seat and added the campaign-style back for ergonomical purposes.

Figure 57. ***Prototype Build***

Figure 58*. Model of Man Sketch Comparison*



Model of Man Sketch



Model of Man Measurements

The following images refer to the final design and how it was built to accommodate different sizes and shapes. Details were important to me while finishing up the flexirocker. Some examples include enhancements such as simple weaving techniques for durability and clear stoppers added for safety to make sure the user cannot over rock.

On the lower left is a 6' tall man who can sit comfortably while leaning back in the chair. On the right is a 5'3" woman who is testing the chair before adding the chair back. With this, the FlexiRocker can accommodate multiple user types.

Reflection

The goal of this design was to make a unique and functional piece that provides support for those who have ADHD. Using a bungee cord for bouncing, grainy wood adding visual texture, and the rocking motion, this chair presents ample opportunity for someone who may require extra sensory stimulation. I hope to create another chair in

the future using the things I have learned from this experience to enhance the design moving forward.

Figure 59. ***FlexiRocker in Use***

Details of Weaving

Stopper for Safety

6'0" Model

5'3" Model

Figure 60. ***The FlexiRocker***

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